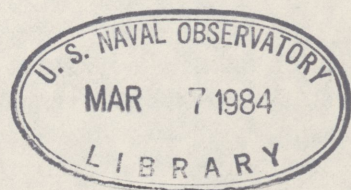


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UNITED STATES NAVAL OBSERVATORY

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U. S. Naval Observatory, Washington, D. C. 20390

February 1, 1984



TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

by

Alan D. Fiala

and

Marie R. Lukac

UNITED STATES NAVAL OBSERVATORY
CIRCULAR NO. 138

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Washington, DC 20390

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TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

3

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[illegible]

GENERAL INFORMATION

A total eclipse of the Sun will occur on Thursday, 22 November and Friday, 23 November 1984. It will be preceded by an associated penumbral eclipse of the Moon on 8 November. The duration of totality will not be great and the portions of land in the path are not favorably located.

The last preceding total eclipse of the Sun was on 11 June 1983 across Indonesia and Papua New Guinea. The next total eclipse of the Sun will occur on 12 November 1985 in the Antarctic. No Circular will be issued for it. The last preceding eclipse in the same saros as the November 1984 eclipse occurred on 12 November 1966 across South America. The next following eclipse in the same saros will be on 4 December 2002 beginning in Africa and ending in Australia. The next Circular planned for a single eclipse will be for the total eclipse of the Sun on 18 March 1988 across Indonesia and the Philippines.

At the time of the eclipse, the Sun and Moon will be in the head of Scorpius near the Milky Way, forming a triangle with second magnitude stars β Sco and δ Sco. In the early part of the path, the Milky Way will be rising straight up from the horizon and passing south of the zenith through the Southern Cross. Antares (+1.0) will lie about 6 degrees northeast of the Sun and Spica (+0.9) high in the north. Canopus (-0.7) will shine in the southwest. Around the horizon will be Arcturus (-0.1) to the northeast, Regulus (+1.4) to the northwest, Procyon (+0.4) to the west, Sirius (-1.5) to the southwest, and Achernar (+0.5) to the south below the Magellanic Clouds. Saturn (+0.5), less than 12 days past conjunction, will be in Libra, about 10 degrees up to the north.

PATH AND VISIBILITY. The only land in the path is in eastern Indonesia at sunrise, Papua New Guinea early in the morning, and a small island (Sandy I., or Sable I.) near the Chesterfield group. At approximately 21h 13m U.T. on 22 November 1984, the center of the umbra of the Moon's shadow will first touch the Earth at sunrise in the Halmahera Islands, beginning the path of total phase. The path will be approximately 20 km wide, and duration will be approximately 27 seconds. Proceeding southeastward through eastern Indonesia and the island of New Guinea, the path will cross into Papua New Guinea 4 minutes later. So far the path will have been over jungle and swamp areas. At 21h 21m U.T. the umbra will sweep past Port Moresby. To the northwest of the city, a small tip of land seems to lie just on the north edge, and Daugo Island does lie inside the path. To the southeast approximately 100 km, at Hula, near Hood Bay, the land mass extends almost to the centerline, and duration of totality (corrected for limb profile) will be 51 seconds out of 57 at the center line. From there, the path will sweep south of New Hebrides, north of New Zealand, crossing only a part of one small island (Sandy I.) at 21h 43m U.T., where duration on the central line will be 86 seconds and on the island no more than 61 seconds (corrected for profile). The umbra will leave the surface of the Earth at sunset off the coast of South America at approximately 0h 34m U.T. on 23 November. Because the track will cross the International Date Line, according to local times the eclipse will begin on Friday 23 November in Indonesia and end on Thursday 22 November in the southeast Pacific Ocean. Maximum duration will be approximately 124 seconds northeast of New Zealand.

Partial phases of the eclipse, of magnitude decreasing with the distance from the path of total phase, will be visible over Australia, New Zealand, the South Pacific Ocean, and portions of Antarctica.

CHANGE IN CONTENTS. The type of information presented in these Circulars has been changing in the last few years, in an effort to satisfy the needs of more observers. For those who wish to chart the path on their own maps, or observe from the air, the path is given as a function of longitude and altitude for accessible regions, with more points given in regions of accessible land. The tables of local circumstances have been rearranged.

PARAMETERS. The predictions in this Circular are derived from the solar and lunar data contained in an ephemeris developed jointly by the Jet Propulsion Laboratory and the U. S. Naval Observatory for use in the *Astronomical Almanac for 1984* and after. In order to best take into account the rough limb of the Moon, the value of $k = 0.2725076$ for the ratio of the radius of the lunar profile to the Earth's radius is used throughout the calculations. The IAU adopted the new value for k in August 1982. Along with that value, corrections have been applied to both lunar latitude and longitude to help account for the difference between center of figure and center of motion. (See Elements of the Eclipse.) It is expected that the observer will then make final limb corrections as described elsewhere in this Circular. As usual, all time arguments are in Universal Time (U.T.), using the best correction available at the time of preparation. Also, the convention of longitude positive east is used.

**LATE NOTE: Defense Mapping Agency reports now that Sandy Island no longer exists. That is based on the report of a French hydrographic surveying expedition in 1979.*

DEFINITIONS OF TERMS.

First and fourth contacts are, respectively, the beginning and the end of the partial phase. *Second and third contacts* are, respectively, the beginning and the end of the total phase, if it occurs at the location given. *Duration* is the time interval between second and third contacts. Dot leaders indicate that a phenomenon occurs below the horizon for the given location.

The *position angle* of a point of contact on the solar limb is measured eastward (counterclockwise) around the solar limb. *P* is the position angle measured from the north point of the limb; *V* is the position angle measured from the vertex point. The north point lies on the great circle arc drawn from the north celestial pole to the center of the solar disk; the vertex lies on the great circle arc drawn from the zenith to the center of the solar disk. If the angle is listed as negative, you may add 360 degrees.

The *azimuth* of the Sun is measured along the horizon clockwise from the north point eastward to the foot of the great circle arc drawn from the zenith through the center of the solar disk down to the horizon. If it is listed as negative, either add 360 or measure westward from north.

The *magnitude* of the eclipse is the fraction of the apparent diameter of the solar disk covered by the Moon at the time of greatest phase, expressed in units of the solar diameter.

Degree of obscuration, prepared especially for this Circular, is the fraction (per cent) of the area of the apparent solar disk obscured by the Moon at maximum eclipse.

Inexperienced observers are cautioned to observe only by use of projected images, and not to use any method which would cause them to look directly toward the Sun.

LOCAL CIRCUMSTANCES. A table of accurate local circumstances for a list of geographic locations is provided. They were selected for location near the path, general geographic distribution, and size of population. Coordinates were taken from *The Times Atlas* or read from the detail maps in this Circular. All coordinates are approximate and assumed to be sea level. The printed circumstances correspond to the printed coordinates, in case there should be an error in identification or coordinates. It is often difficult in preparing maps and local circumstances to ascertain the correct name and spelling for a given location. Therefore, the information presented here is for location purposes only, is not authoritative, and does not imply official recognition of the status of any area by the United States government.

For the user who wishes to calculate his own local circumstances, the elements of conjunction, general circumstances, and Besselian Elements for Universal Time arguments are presented. The Besselian Elements are given as usual in tabular form, and also in polynomial form, courtesy of Dr. L. E. Doggett. Precepts for the calculations of local circumstances may be found in the Explanation of any recent *Astronomical Almanac*.

ESTIMATING LOCAL CIRCUMSTANCES

CONTACT TIMES. Beginning and end of the partial phase, or first and last contacts, can be estimated using the one-page overall map reproduced from the *Astronomical Almanac*. The dashed lines show the surface outline of the Moon's penumbra at a time interval of 30 minutes. The short dashes show the leading edge, the long dashes show the trailing edge. First contact occurs when the leading edge passes over the location in question, last contact occurs when the trailing edge passes. Duration is the time difference between contacts. The time halfway between is the middle of the eclipse. This is near the time of maximum eclipse, but not necessarily identical. At a given location, one need only estimate the intermediate position of the penumbra's edge between the starting and ending lines on either side and thus the time of the contact. For observers within the elongated teardrop curves to the extreme east and west, part of the eclipse occurs below the horizon.

Low precision times of second and third contacts in the central path can also be estimated. The central path over land is shown on a series of detail maps in the last part of this Circular. A few pages before the maps is a table of Local Circumstances for Points on the Central Line. On the maps, the heavy solid lines mark the northern and southern limits of the predicted path. Each dashed line represents the projection of the diameter of the umbra, joining the northern and southern limits and central point for the indicated instant—at which all points on the dashed line observe maximum eclipse.

Use the maps and the table as follows: Find on the maps the location in the path for which you want local circumstances. From the one-minute cross lines on either side, estimate or measure the time t_0 when the projected axis line of the umbra will pass over the point. Turn to the Table of Local Circumstances for Points on the Central Line. Find where the time t_0 fits into the first column on each page. Using the appropriate fraction of the time interval, read across both pages and interpolate the times of second and third contacts, the duration (D), and width of path. Make a note of the angles P and V for each contact, and also the altitude (a) and azimuth (A) of the Sun at maximum eclipse. Turn back to the map. If you mark the cross lines for the second and third contact times, you can see the breadth of the projected shadow. Now draw a line through the observing point perpendicular to the path. Estimate or measure how far the point is from the center of the path and call this quantity a. Set b equal to half the width of the path. Next compute the approximate duration (T) for the selected location by $T = D\sqrt{1 - (b/a)^2}$. Then the time of second contact is approximately $t_0 - T/2$, third contact $t_0 + T/2$.

POSITION ANGLES. The appropriate profile for this eclipse is reproduced from *Circular No. 141*. For locations in the central path, the predicted times and position angles of contacts are based on the Moon's mean limb (the dashed circle). Correction for limb irregularities is discussed later. In working with this construction, remember that position angles are given for the solar disk, which is observable, but corrections are based on features on the lunar disk, shown in the diagram. The two nearly coincide between second and third contacts, so it is adequate to plot angles pertaining to the Sun on the lunar diagram. However, this is not the case for first and fourth contacts. You may find it convenient to use a transparent overlay with a circle of radius three inches.

For each second or third contact to be sketched, take from the tables the time of contact (t_c), the angles P and V, and the altitude (a) and azimuth (A) of the Sun at maximum eclipse, as described above. Convert the time of contact to hours and decimals. Compute the angle C from the following equation, in which all numerical quantities are degrees:

$$C = 14.94 - 0.197t_c + 0.377 \sin(90 - a) \sin(P - V).$$

On the diagram, N marks lunar north. Using the four direction tick marks, find the center of the circle. Draw a line from the center through N. Next measure the angle C westward (clockwise) from N. Mark the point on the mean limb and draw a line from the center through it. This points to the Earth's north celestial pole. From this line, measure back the angle P eastward (counterclockwise) to find the point of contact on the mean limb. Draw a line from the center out through that point. Finally, from that line, measure through the angle V westward (clockwise). Draw a line from the center through this point. This line points to the observer's zenith. Now you can visualize events as follows: Face in the direction of the Sun's azimuth (A), measured in degrees positively from the north point of the horizon around clockwise to the east, hold the diagram up at arm's length at the altitude (a) of the Sun at maximum eclipse, and turn it so that the line pointing to the zenith points straight up. The line to the north point of the disk will point to celestial north for the observing site, and the point of contact at the limb will be at its correct apparent orientation.

To get position angles for locations not listed in the tables, follow the directions above and plot the points of second and third contacts for the interpolated location *on the center line*. Draw a line connecting the two contacts on the mean limb. It should pass through the center of the disk. Next, draw or construct a perpendicular diameter, which runs approximately north/south. Taking (b/a) from the calculation of duration, measure off (b/a) $\times$ radius from the center of the circle along the north/south diameter in the opposite direction as the observing site. Mark the point on the diameter, and draw or construct a perpendicular line parallel to the one through the central line contact points. This new line will intersect the mean limb at approximately the points of contact. The eastern point is for second contact, the western is for third contact. This construction is not as accurate as a full calculation, but adequate for field estimates.

ACKNOWLEDGEMENTS. Marie Lukac prepared the overall line map and the detail maps of the path over land. The latter is presented on portions of Operational Navigation Charts (ONC) M-12, M-13, N-14, N-15, P-15, scale 1:1,000,000, Lambert Conformal Conic Projection. These maps are a product of Defense Mapping Agency Aerospace Center. The portions in this Circular are reduced to 60% of original size, enlarging the scale from 15.78 miles/inch to 26.3 miles/inch. Map sheets may be purchased by ordering from this address:

NOAA Distribution Branch N/CG33
National Ocean Service
Riverdale MD 20737
(\$5.00 each in 1983)

The Lunar Limb Profile chart is from *U. S. Naval Observatory Circular No. 141*, "Lunar Limb Profiles for Solar Eclipses," by Julena S. Duncombe, March 16, 1973.

The polynomial representation of the Besselian Elements was programmed by Dr. Leroy Doggett, Nautical Almanac Office.

Climatological data was contributed by a meteorologist, Jay Anderson, of Winnipeg, Manitoba.

OBSERVATIONS. Precise observations of the second and third contact times, at any part of the path, but especially the northern and southern limits, are needed and requested. Since precise coordinates of the observer must be determined, reports of such timings should include location information such as nearest settlement, roads to the site, distance to nearby buildings and the nearest road intersection, distance from the center of the road, etc. The method of timing should also be described. Please send reports to

Nautical Almanac Office
U. S. Naval Observatory
Washington, D.C. 20390, U. S. A.

Information on photography, direct viewing, and projection methods may be found in the following publications:

"Safe Solar Filters," by B. Ralph Chou, *Sky and Telescope*, August 1981, p. 119.

"Observing the Sun in Safety," by J. C. D. Marsh, *J. Brit. astron. Assoc.*, 1982, 92, 6, p. 237.

Astrophotography Basics, Kodak Customer Service Pamphlet AC-48, 1981.

A Complete Manual of Amateur Astronomy, by P. Clay Sherrod, Prentice Hall, 1981.

Eclipse, by Bryan Brewer, 1979.

Observe: Eclipses, by R. Sweetsir and M. Reynolds, Astronomical League, 1979.

FURTHER INFORMATION. Inquiries concerning special calculation of local circumstances and extensions or modifications of data in this publication should be directed to the Nautical Almanac Office.

Papua New Guinea has a committee for the eclipse:

Alfred W. Kruijshoop
Chairman, Solar Eclipse Committee
Office of the Ministry of Education
P.S.A. House
Private Mail Bag
Post Office
BOROKO
Papua New Guinea

LUNAR LIMB PROFILE

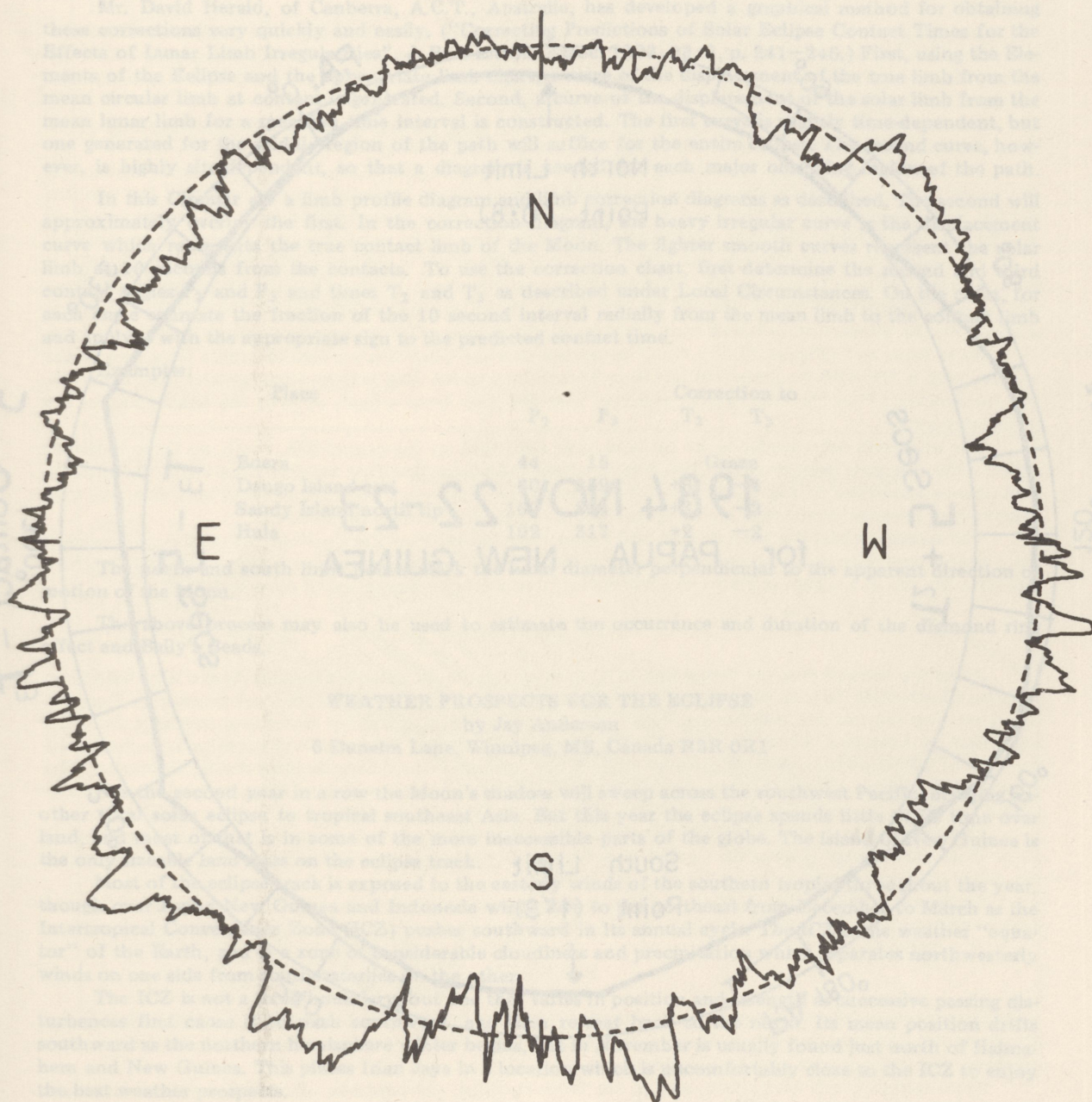
L=+4°00

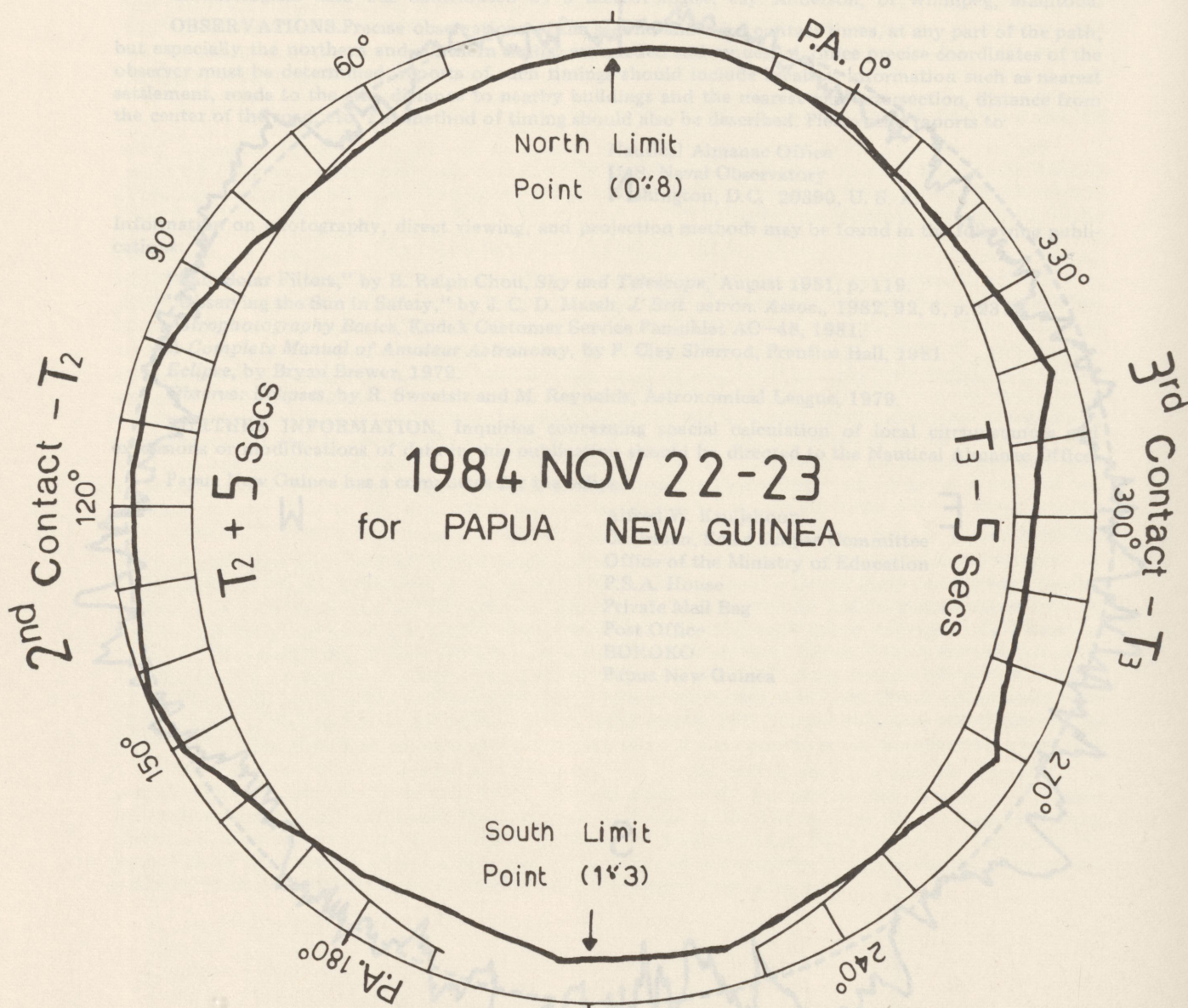
B=0°00

RADIAL SCALE: 1 SECOND OF ARC = 

DOTTED LINE = MEAN LIMB

SOLID LINE = TRUE LIMB





LIMB CORRECTIONS

For locations in the central path, the predicted times and position angles of contacts are based on the Moon's mean limb, assumed to be a circle. There is a further correction for irregularities of the limb which has not been applied to the predictions printed in this publication. They should be applied, however, to second and third contacts because of the corrections for center of figure and the lunar profile radius k which have been used.

For a total eclipse, actual contact occurs not at the mean lunar limb, but at the lowest point of any feature along the limb near the predicted contact point. Inspection of the profile chart will reveal these features. The Moon is gaining on the Sun at approximately 0.6 seconds of arc per second of time. Measuring the difference radially between the mean and true limbs at the contact point and comparing that to the scale segment will give an estimate of the time correction to be applied to the contacts. In general, second contact will be late and third contact early.

Mr. David Herald, of Canberra, A.C.T., Australia, has developed a graphical method for obtaining these corrections very quickly and easily. ("Correcting Predictions of Solar Eclipse Contact Times for the Effects of Lunar Limb Irregularities", J. Brit. astron. Assoc. 1983, 93, 6, p. 241-246.) First, using the Elements of the Eclipse and the appropriate limb chart, a curve of the displacement of the true limb from the mean circular limb at contact is generated. Second, a curve of the displacement of the solar limb from the mean lunar limb for a specified time interval is constructed. The first curve is slightly time-dependent, but one generated for the middle region of the path will suffice for the entire eclipse. The second curve, however, is highly site-dependent, so that a diagram is needed for each major observing region of the path.

In this Circular are a limb profile diagram and limb correction diagrams as described. The second will approximately overlay the first. In the correction diagram, the heavy irregular curve is the displacement curve which represents the true contact limb of the Moon. The lighter smooth curves represent the solar limb at 10 seconds from the contacts. To use the correction chart, first determine the second and third contact angles P_2 and P_3 and times T_2 and T_3 as described under Local Circumstances. On the chart, for each angle estimate the fraction of the 10 second interval radially from the mean limb to the contact limb and apply it with the appropriate sign to the predicted contact time.

Examples:

Place	P_2 P_3		Correction to	
	P_2	P_3	T_2	T_3
Boera	44	15	Graze	
Daugo Island east	60	359	+6	-4
Sandy Island north tip	160	264	+3	-3
Hula	102	317	+2	-2

The north and south limit points mark the lunar diameter perpendicular to the apparent direction of motion of the Moon.

The above process may also be used to estimate the occurrence and duration of the diamond ring effect and Bailey's Beads.

WEATHER PROSPECTS FOR THE ECLIPSE

by Jay Anderson

6 Dunelm Lane, Winnipeg, MB, Canada R3R 0R1

For the second year in a row the Moon's shadow will sweep across the southwest Pacific, bringing another total solar eclipse to tropical southeast Asia. But this year the eclipse spends little of its time over land, and most of that is in some of the more inaccessible parts of the globe. The island of New Guinea is the only sizeable land mass on the eclipse track.

Most of the eclipse track is exposed to the easterly winds of the southern tropics throughout the year, though over Papua New Guinea and Indonesia winds turn to the northeast from December to March as the Intertropical Convergence Zone (ICZ) pushes southward in its annual cycle. The ICZ is the weather "equator" of the Earth, and is a zone of considerable cloudiness and precipitation which separates northwesterly winds on one side from southeasterlies on the other.

The ICZ is not a fixed boundary, but one that varies in position and strength as successive passing disturbances first cause it to push southward, and then retreat back to the north. Its mean position drifts southward as the northern hemisphere winter begins, but in November is usually found just north of Halma-hera and New Guinea. This places Irian Jaya in a location which is uncomfortably close to the ICZ to enjoy the best weather prospects.

WEATHER PROSPECTS (Continued)

NEW GUINEA (The entire island)

Most cloud and precipitation in equatorial islands is related to the flow of the winds rather than the presence of specific weather disturbances, as is the case in more temperate zones. This is because moist tropical air which is forced to rise over mountainous terrain quickly becomes saturated, bringing cloud and precipitation to windward slopes. Conversely, descending air on leeward slopes tends to dry, and clouds dissipate.

But even over mountainous New Guinea there are areas which receive relatively little rainfall during the eclipse season. One of the most promising for observers is found in the vicinity of Port Moresby (Fig. 2). The explanation for this dry region may lie in the alignment of the coast, which angles across the prevailing southeast winds. Due to differences in friction between the land and the water, the flow is spread as it moves off the land, and the air aloft descends into the region of spreading, drying and bringing a reduction in rainfall.

However, the absence of precipitation does not guarantee a cloudless sky, and weather station statistics are not as encouraging as the rainfall chart. Jackson Aerodrome (at Port Moresby) has only a 12% frequency of less than 3 tenths cloud cover, good for the region, but discouraging overall. This may not be the last word however, as the eclipse will very likely be visible with up to 6 tenths sky cover.

Studies of cloud cover based on satellite photos are more encouraging, though covering fewer years. They show that prospects in the Port Moresby area are quite promising.

Farther west the eclipse track lies parallel to and in the foothills of the mountainous spine which runs the length of the island. In this region the moist southeast winds intersect rising terrain and the seasonal rainfall is much greater than that near Port Moresby. Cloud cover is probably heavy, but in any event, access to the area is likely difficult, as it has been billed as "one of the most extensive swamps in the world."

It is unfortunate that the centre line of the eclipse does not touch the coast of Papua New Guinea at Port Moresby, though it passes close offshore. However there may be some advantages to be gained from this, if the observer can place himself on the water. Since weather conditions in the tropics depend so strongly on the interaction between wind and terrain, conditions offshore may be superior to those on land.

As it turns out (Figure 1), the cloud prospects over the Coral Sea are also favorable for a view of the eclipse, with a 30-40% frequency of less than 3 tenths sky cover. This is three times greater than the statistics for Jackson (Port Moresby) show, and hint that the view from a boat, or even the beach, may be the most promising.

For observers who prefer to be on land, and also right on the center line, there are three locations which offer 'second-best' chances. The first is where the center line first reaches Irian Jaya. This has the best chance according to Fig. 2, but the sun will be so low that even a small cloud cover may interfere with observation, because perspective makes clouds appear to thicken toward the horizon.

The second, where the path crosses into Papua New Guinea near Tanahmerah, has very poor prospects for a sunny day. The third, where the shadow enters the Gulf of Papua near the mouth of the Bamu River, will have the sun at a higher altitude, but will suffer from a greater likelihood of cloudiness.

THE CORAL SEA

After the Moon's shadow leaves Papua New Guinea, it tracks southwestward between New Caledonia and the Chesterfield Islands and Australia. It is here that the climate statistics are most promising. Figure 1, based on ship reports and satellite pictures, shows that a zone of minimum cloudiness stretches from the east coast of Australia, across the eclipse track, to New Caledonia. This region of sunshine is probably the creation of a semi-permanent high pressure ridge which lingers north of New Zealand during November. The effects of this ridge are apparent in the statistics for Noumea: it has the highest frequency of sunny weather and the smallest number of days with rainfall of any site close to the center line.

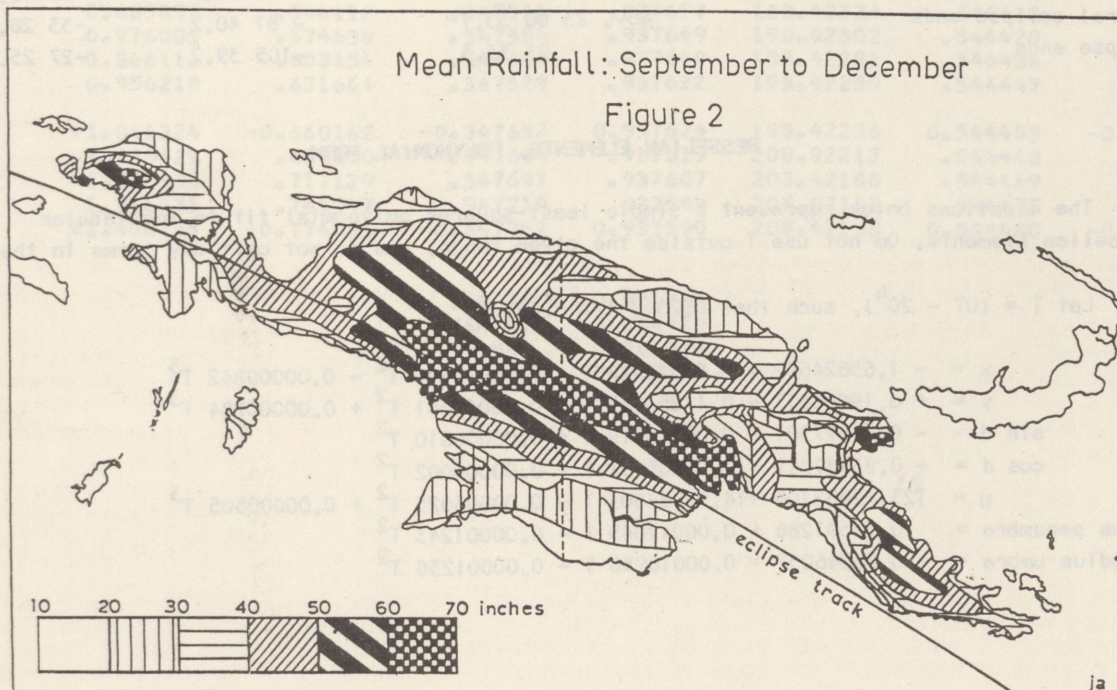
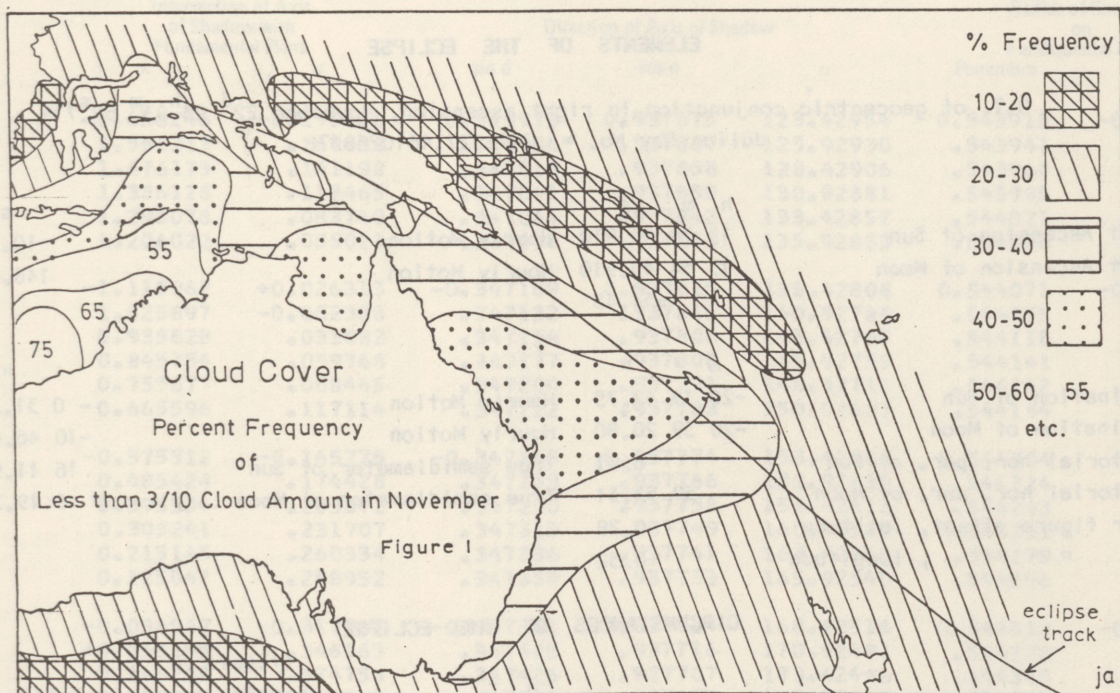
Observers aboard ship will have the advantage of mobility, as well as access to the most promising sites. What cloud there is over the Coral Sea is likely to consist of cumulus and towering cumulus, which can easily be skirted to seek the sunny places in between.

Typhoons are frequent visitors to the Coral Sea during the southern hemisphere's summer, but the season does not begin until December. It is unlikely that they would be a problem during the eclipse.

SUMMARY

Irian Jaya and Papua New Guinea, with the exception of the Port Moresby area, offer poor weather prospects for viewing this eclipse. The Coral Sea and Chesterfield Island area offer much better chances for sunshine, particularly west of New Caledonia.

Since mobility will be limited, except for those on ships, site selection can only be made on the basis of past climatological record. This record favors Sandy Island (Sable Island) over a site near Port Moresby.



ELEMENTS OF THE ECLIPSE

U.T. of geocentric conjunction in right ascension, November 22^d 23^h 03^m 52^s.719

Julian Day No. = 2446027.4610268378

	h	m	s		s
Right Ascension of Sun	15	54	45.910	Hourly Motion	10.551
Right Ascension of Moon	15	54	45.910	Hourly Motion	148.612
ΔT			+54.45		
	°	'	"		'
Declination of Sun	-20	19	42.75	Hourly Motion	- 0 31.36
Declination of Moon	-20	39	20.80	Hourly Motion	-10 46.07
Equatorial hor. par. of Sun			8.91	True semidiameter of Sun	16 11.9
Equatorial hor. par. of Moon			59 53.51	True semidiameter of Moon	6 19.2
Lunar figure offset, latitude			-0.28		
" , longitude			+0.52		

CIRCUMSTANCES OF THE ECLIPSE

	U. T.	(+East) Longitude	Latitude
	d h m	° '	° '
Eclipse begins	Nov. 22 20 13.4	+145 18.3	+ 5 37.0
Central eclipse begins	21 12.9	+128 08.3	- 0 34.6
Central eclipse at local apparent noon	23 03.9	-169 23.7	-39 43.9
Central eclipse ends	Nov. 23 00 33.7	- 87 40.2	-33 28.0
Eclipse ends	01 33.3	-105 39.2	-27 25.7

BESSELIAN ELEMENTS, POLYNOMIAL FORM

The equations below represent a simple least-squares polynomial fit to the tabular Besselian Elements. Do not use T outside the given range, and do not omit any terms in the series.

Let $T = (UT - 20^h)$, such that $0^h.25 \leq T \leq 5^h.667$

$$\begin{aligned}
 x &= -1.65624652 + 0.54018526 T + 0.00010790 T^2 - 0.00000842 T^3 \\
 y &= +0.19868617 - 0.17250967 T + 0.00013381 T^2 + 0.00000284 T^3 \\
 \sin d &= -0.34697301 - 0.00013619 T + 0.00000010 T^2 \\
 \cos d &= +0.93787511 - 0.00005037 T + 0.00000002 T^2 \\
 \mu &= 123.42952706 + 14.99858603 T - 0.00003025 T^2 + 0.00000505 T^3 \\
 \text{Radius penumbra} &= 0.54391288 + 0.00017045 T - 0.00001243 T^2 \\
 \text{Radius umbra} &= -0.00246057 + 0.00016958 T - 0.00001236 T^2
 \end{aligned}$$

BESSELIAN ELEMENTS

U.T. h m	Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane	
	x	y	sin d	cos d	μ °	Penumbra	Umbra
20 00	-1.656246	+0.198686	-0.346973	0.937875	123.42954	0.543913	-0.002461
10	1.566213	.169938	.346996	.937867	125.92930	.543941	.002433
20	1.476173	.141198	.347018	.937858	128.42906	.543968	.002405
30	1.386128	.112465	.347041	.937850	130.92881	.543995	.002379
40	1.296078	.083740	.347064	.937842	133.42857	.544021	.002353
50	1.206022	.055023	.347086	.937833	135.92833	.544046	.002328
21 00	-1.115962	+0.026313	-0.347109	0.937825	138.42808	0.544071	-0.002303
10	1.025897	-0.002388	.347132	.937816	140.92784	.544095	.002280
20	0.935828	.031082	.347154	.937808	143.42760	.544118	.002256
30	0.845754	.059768	.347177	.937800	145.92735	.544141	.002234
40	0.755677	.088445	.347200	.937791	148.42711	.544162	.002212
50	0.665596	.117114	.347222	.937783	150.92687	.544184	.002191
22 00	-0.575512	-0.145775	-0.347245	0.937774	153.42662	0.544204	-0.002171
10	0.485424	.174428	.347268	.937766	155.92638	.544224	.002151
20	0.395334	.203072	.347290	.937758	158.42613	.544243	.002132
30	0.305241	.231707	.347313	.937749	160.92589	.544261	.002114
40	0.215145	.260334	.347336	.937741	163.42565	.544279	.002096
50	0.125047	.288952	.347358	.937733	165.92540	.544296	.002079
23 00	-0.034947	-0.317562	-0.347381	0.937724	168.42516	0.544312	-0.002063
10	+0.055155	.346163	.347403	.937716	170.92491	.544328	.002047
20	0.145258	.374754	.347426	.937707	173.42466	.544343	.002033
30	0.235363	.403337	.347449	.937699	175.92441	.544357	.002018
40	0.325468	.431910	.347471	.937691	178.42417	.544371	.002005
50	0.415575	.460475	.347494	.937682	180.92392	.544384	.001992
00 00	+0.505682	-0.489030	-0.347516	0.937674	183.42368	0.544396	-0.001980
10	0.595789	.517576	.347539	.937666	185.92346	.544408	.001968
20	0.685897	.546112	.347561	.937657	188.42324	.544418	.001958
30	0.776005	.574639	.347584	.937649	190.92302	.544429	.001948
40	0.866112	.603156	.347607	.937640	193.42281	.544438	.001938
50	0.956218	.631664	.347629	.937632	195.92259	.544447	.001929
01 00	+1.046324	-0.660162	-0.347652	0.937624	198.42236	0.544455	-0.001921
10	1.136429	.688650	.347674	.937615	200.92212	.544462	.001914
20	1.226533	.717129	.347697	.937607	203.42188	.544469	.001907
30	1.316635	.745597	.347719	.937599	205.92163	.544475	.001901
01 40	+1.406735	-0.774055	-0.347742	0.937590	208.42138	0.544480	-0.001896

TAN F1 0.004735

TAN F2 0.004712

MU' 0.261773

D' -0.000145

PATH OF THE TOTAL PHASE

Universal Time h m	Northern Limit		Central Line		Southern Limit	
	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude
LIMIT	+128 12.8	- 0 26.9	+128 08.3	- 0 34.6	+128 03.8	- 0 42.2
21 13	+131 44.7	- 1 48.5	+130 34.7	- 1 31.0	+128 26.1	- 0 50.8
21 14	+135 59.3	- 3 37.6	+135 25.1	- 3 34.8	+134 49.7	- 3 31.2
21 15	+138 28.4	- 4 47.5	+137 59.7	- 4 47.6	+137 30.5	- 4 47.1
21 16	+140 23.0	- 5 44.5	+139 56.8	- 5 46.1	+139 30.3	- 5 47.3
21 17	+141 58.7	- 6 34.3	+141 33.9	- 6 36.9	+141 08.9	- 6 39.3
21 18	+143 22.0	- 7 19.3	+142 58.2	- 7 22.8	+142 34.1	- 7 26.0
21 19	+144 36.4	- 8 00.8	+144 13.2	- 8 05.0	+143 49.9	- 8 08.9
21 20	+145 44.0	- 8 39.7	+145 21.3	- 8 44.4	+144 58.4	- 8 48.9
21 21	+146 46.2	- 9 16.5	+146 23.8	- 9 21.7	+146 01.4	- 9 26.7
21 22	+147 43.9	- 9 51.4	+147 21.9	- 9 57.1	+146 59.7	-10 02.5
21 23	+148 38.0	-10 24.9	+148 16.2	-10 31.0	+147 54.3	-10 36.8
21 24	+149 29.0	-10 57.1	+149 07.4	-11 03.5	+148 45.6	-11 09.8
21 26	+151 03.2	-11 58.2	+150 41.8	-12 05.4	+150 20.3	-12 12.3
21 28	+152 29.0	-12 55.8	+152 07.8	-13 03.5	+151 46.5	-13 11.1
21 30	+153 48.2	-13 50.5	+153 27.1	-13 58.8	+153 05.9	-14 06.9
21 35	+156 44.3	-15 57.3	+156 23.4	-16 06.7	+156 02.4	-16 16.0
21 40	+159 18.2	-17 53.3	+158 57.4	-18 03.8	+158 36.4	-18 14.1
21 42	+160 15.2	-18 37.3	+159 54.4	-18 48.2	+159 33.4	-18 58.9
21 44	+161 10.1	-19 20.2	+160 49.2	-19 31.4	+160 28.3	-19 42.5
21 46	+162 03.1	-20 02.0	+161 42.2	-20 13.6	+161 21.3	-20 25.0
21 48	+162 54.4	-20 42.8	+162 33.6	-20 54.7	+162 12.7	-21 06.5
21 50	+163 44.3	-21 22.7	+163 23.6	-21 34.9	+163 02.7	-21 47.1
21 55	+165 43.9	-22 58.8	+165 23.1	-23 11.9	+165 02.3	-23 24.8
22 00	+167 37.5	-24 30.3	+167 16.8	-24 44.2	+166 56.1	-24 57.9
22 05	+169 26.8	-25 57.9	+169 06.3	-26 12.4	+168 45.7	-26 26.8
22 10	+171 13.2	-27 21.8	+170 52.9	-27 37.0	+170 32.5	-27 52.2
22 15	+172 57.6	-28 42.4	+172 37.6	-28 58.3	+172 17.4	-29 14.1
22 20	+174 41.1	-30 00.0	+174 21.3	-30 16.5	+174 01.5	-30 33.0
22 25	+176 24.3	-31 14.6	+176 04.9	-31 31.8	+175 45.5	-31 48.9
22 30	+178 08.0	-32 26.5	+177 49.1	-32 44.3	+177 30.1	-33 02.1
22 35	+179 52.8	-33 35.7	+179 34.5	-33 54.1	+179 16.0	-34 12.4
22 40	-178 20.7	-34 42.2	-178 38.4	-35 01.2	-178 56.1	-35 20.1
22 45	-176 31.9	-35 46.1	-176 48.8	-36 05.6	-177 05.8	-36 25.1
22 50	-174 40.2	-36 47.3	-174 56.2	-37 07.3	-175 12.4	-37 27.3
22 55	-172 45.1	-37 45.8	-173 00.2	-38 06.3	-173 15.3	-38 26.7
23 00	-170 46.0	-38 41.5	-171 00.0	-39 02.4	-171 14.1	-39 23.3
23 10	-166 33.8	-40 24.0	-166 45.3	-40 45.5	-166 56.8	-41 07.1
23 20	-161 59.0	-41 53.4	-162 07.4	-42 15.4	-162 15.8	-42 37.4
23 30	-156 56.6	-43 07.9	-157 01.3	-43 30.0	-157 06.0	-43 52.0
23 40	-151 20.6	-44 04.6	-151 21.2	-44 26.3	-151 21.7	-44 48.0
23 50	-145 03.6	-44 39.5	-144 59.7	-45 00.3	-144 55.6	-45 21.1
0 00	-137 54.8	-44 46.5	-137 46.2	-45 05.7	-137 37.2	-45 24.8
0 10	-129 35.3	-44 15.5	-129 21.8	-44 32.2	-129 08.0	-44 48.7
0 20	-119 21.1	-42 45.5	-119 02.8	-42 58.2	-118 44.0	-43 10.7
0 30	-104 15.0	-39 01.4	-103 49.0	-39 06.5	-103 22.6	-39 11.1
0 31	-101 56.0	-38 18.8	-101 28.0	-38 22.2	-100 59.5	-38 25.2
0 32	- 99 09.9	-37 25.4	- 98 38.3	-37 26.5	- 98 06.0	-37 26.9
0 33	- 95 27.6	-36 10.2	- 94 47.0	-36 06.3	- 94 04.1	-36 01.2
LIMIT	- 87 45.1	-33 21.7	- 87 40.2	-33 28.0	- 87 35.2	-33 34.4

For duration, path width, and altitude and azimuth of the sun, please see page 20, Local Circumstances for Points on the Central Line

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

17

SURFACE PATH OF THE TOTAL PHASE OVER LAND

Longitude	Northern Limit	Latitude of Central Line	Southern Limit	Universal Time at			On Central Line			Sun's
				Northern Limit	Central Line	Southern Limit	Maximum Duration	Path Width	Alt.	
° ' "	° ' "	° ' "	° ' "	h m s	h m s	h m s	m s	km	°	°
+131 00.0		- 1 41.5	- 1 53.4		21 13 04.3	21 13 17.4	0 30.9	36	3	110
+131 30.0		- 1 54.0	- 2 05.6		21 13 09.2	21 13 20.8	0 31.5	37	4	110
+132 00.0	- 1 54.9	- 2 06.5	- 2 17.8	21 13 03.1	21 13 14.1	21 13 24.1	0 32.2	38	4	110
+132 30.0	- 2 07.5	- 2 18.9	- 2 30.0	21 13 09.0	21 13 19.1	21 13 27.5	0 32.9	38	5	110
+133 00.0	- 2 20.0	- 2 31.4	- 2 42.4	21 13 14.8	21 13 24.0	21 13 31.4	0 33.6	39	5	110
+133 30.0	- 2 32.6	- 2 43.9	- 2 55.2	21 13 20.7	21 13 29.0	21 13 37.3	0 34.3	40	6	110
+134 00.0	- 2 45.2	- 2 56.7	- 3 08.4	21 13 26.6	21 13 35.4	21 13 44.4	0 35.0	40	6	110
+134 30.0	- 2 57.9	- 3 09.9	- 3 22.0	21 13 33.1	21 13 43.1	21 13 53.3	0 35.7	41	7	110
+135 00.0	- 3 11.0	- 3 23.3	- 3 35.9	21 13 41.3	21 13 51.9	21 14 03.2	0 36.4	42	8	110
+135 30.0	- 3 24.4	- 3 37.0	- 3 49.7	21 13 50.3	21 14 01.7	21 14 12.9	0 37.2	42	8	110
+136 00.0	- 3 37.9	- 3 50.8	- 4 03.7	21 14 00.3	21 14 11.7	21 14 23.5	0 37.9	43	9	110
+136 30.0	- 3 51.6	- 4 04.7	- 4 17.9	21 14 10.8	21 14 22.7	21 14 34.8	0 38.7	44	9	110
+137 00.0	- 4 05.5	- 4 18.9	- 4 32.3	21 14 22.1	21 14 34.4	21 14 46.9	0 39.4	45	10	110
+137 30.0	- 4 19.6	- 4 33.2	- 4 46.9	21 14 34.2	21 14 46.9	21 14 59.9	0 40.2	45	11	110
+138 00.0	- 4 33.9	- 4 47.7	- 5 01.7	21 14 47.1	21 15 00.2	21 15 13.6	0 41.0	46	11	110
+138 30.0	- 4 48.3	- 5 02.4	- 5 16.6	21 15 00.9	21 15 14.4	21 15 28.2	0 41.8	47	12	110
+139 00.0	- 5 03.0	- 5 17.3	- 5 31.8	21 15 15.4	21 15 29.4	21 15 43.6	0 42.6	48	12	110
+139 30.0	- 5 17.8	- 5 32.4	- 5 47.2	21 15 30.8	21 15 45.2	21 15 59.9	0 43.4	48	13	110
+140 00.0	- 5 32.8	- 5 47.7	- 6 02.7	21 15 47.0	21 16 01.9	21 16 17.1	0 44.2	49	14	110
+140 30.0	- 5 48.1	- 6 03.2	- 6 18.5	21 16 04.1	21 16 19.5	21 16 35.2	0 45.0	50	14	109
+141 00.0	- 6 03.5	- 6 18.9	- 6 34.5	21 16 22.2	21 16 38.0	21 16 54.2	0 45.9	51	15	109
+141 30.0	- 6 19.1	- 6 34.8	- 6 50.7	21 16 41.1	21 16 57.5	21 17 14.2	0 46.7	51	16	109
+142 00.0	- 6 35.0	- 6 50.9	- 7 07.1	21 17 01.0	21 17 17.8	21 17 35.1	0 47.6	52	16	109
+142 30.0	- 6 51.0	- 7 07.2	- 7 23.7	21 17 21.7	21 17 39.2	21 17 57.0	0 48.5	53	17	109
+143 00.0	- 7 07.2	- 7 23.8	- 7 40.5	21 17 43.5	21 18 01.5	21 18 19.9	0 49.4	54	17	109
+143 30.0	- 7 23.7	- 7 40.5	- 7 57.5	21 18 06.2	21 18 24.8	21 18 43.7	0 50.3	54	18	109
+144 00.0	- 7 40.3	- 7 57.5	- 8 14.7	21 18 30.0	21 18 49.1	21 19 08.6	0 51.2	55	19	109
+144 30.0	- 7 57.2	- 8 14.6	- 8 32.2	21 18 54.7	21 19 14.4	21 19 34.5	0 52.1	56	19	109
+145 00.0	- 8 14.3	- 8 32.0	- 8 49.8	21 19 20.4	21 19 40.8	21 20 01.5	0 53.0	57	20	109
+145 30.0	- 8 31.6	- 8 49.6	- 9 07.7	21 19 47.2	21 20 08.2	21 20 29.6	0 53.9	57	21	108
+146 00.0	- 8 49.1	- 9 07.4	- 9 25.8	21 20 15.1	21 20 36.7	21 20 58.7	0 54.9	58	21	108
+146 30.0	- 9 06.8	- 9 25.4	- 9 44.2	21 20 44.0	21 21 06.3	21 21 29.0	0 55.8	59	22	108
+147 00.0	- 9 24.8	- 9 43.6	- 10 02.7	21 21 14.1	21 21 37.0	21 22 00.4	0 56.8	60	23	108
+147 30.0	- 9 42.9	- 10 02.1	- 10 21.5	21 21 45.2	21 22 08.8	21 22 32.9	0 57.8	60	23	108
+148 00.0	- 10 01.3	- 10 20.8	- 10 40.5	21 22 17.5	21 22 41.8	21 23 06.6	0 58.8	61	24	108
+148 30.0	- 10 19.9	- 10 39.7	- 10 59.7	21 22 50.9	21 23 15.9	21 23 41.5	0 59.8	62	25	108
+149 00.0	- 10 38.7	- 10 58.8	- 11 19.2	21 23 25.5	21 23 51.2	21 24 17.6	1 00.8	63	26	107
+149 30.0	- 10 57.7	- 11 18.2	- 11 38.8	21 24 01.3	21 24 27.8	21 24 54.8	1 01.8	63	26	107
+150 00.0	- 11 17.0	- 11 37.7	- 11 58.7	21 24 38.2	21 25 05.5	21 25 33.3	1 02.9	64	27	107
+150 30.0	- 11 36.4	- 11 57.5	- 12 18.8	21 25 16.4	21 25 44.4	21 26 13.1	1 03.9	65	28	107
+151 00.0	- 11 56.1	- 12 17.5	- 12 39.2	21 25 55.8	21 26 24.6	21 26 54.1	1 05.0	66	28	107
+151 30.0	- 12 16.0	- 12 37.8	- 12 59.7	21 26 36.5	21 27 06.1	21 27 36.3	1 06.0	66	29	106
+152 00.0	- 12 36.1	- 12 58.2	- 13 20.5	21 27 18.4	21 27 48.8	21 28 19.9	1 07.1	67	30	106
+152 30.0	- 12 56.5	- 13 18.9	- 13 41.5	21 28 01.5	21 28 32.8	21 29 04.7	1 08.2	68	31	106
+153 00.0	- 13 17.0	- 13 39.7	- 14 02.7	21 28 46.0	21 29 18.1	21 29 50.9	1 09.3	68	31	106
+153 30.0	- 13 37.8	- 14 00.8	- 14 24.1	21 29 31.7	21 30 04.7	21 30 38.4	1 10.4	69	32	105
+154 00.0	- 13 58.8	- 14 22.1	- 14 45.7	21 30 18.8	21 30 52.6	21 31 27.2	1 11.5	70	33	105
+154 30.0	- 14 20.0	- 14 43.6	- 15 07.6	21 31 07.2	21 31 41.9	21 32 17.3	1 12.6	71	34	105
+155 00.0	- 14 41.3	- 15 05.3	- 15 29.6	21 31 56.9	21 32 32.4	21 33 08.8	1 13.7	71	34	105
+155 30.0	- 15 02.9	- 15 27.3	- 15 51.8	21 32 47.9	21 33 24.4	21 34 01.6	1 14.9	72	35	104
+156 00.0	- 15 24.7	- 15 49.4	- 16 14.3	21 33 40.2	21 34 17.6	21 34 55.8	1 16.0	73	36	104
+156 30.0	- 15 46.7	- 16 11.7	- 16 36.9	21 34 34.0	21 35 12.2	21 35 51.3	1 17.1	73	37	104
+157 00.0	- 16 08.9	- 16 34.1	- 16 59.7	21 35 29.0	21 36 08.2	21 36 48.2	1 18.3	74	37	103
+157 30.0	- 16 31.2	- 16 56.8	- 17 22.7	21 36 25.4	21 37 05.5	21 37 46.4	1 19.5	74	38	103
+158 00.0	- 16 53.7	- 17 19.6	- 17 45.8	21 37 23.2	21 38 04.2	21 38 46.0	1 20.6	75	39	102
+158 30.0	- 17 16.4	- 17 42.7	- 18 09.1	21 38 22.3	21 39 04.2	21 39 46.9	1 21.8	76	40	102
+159 00.0	- 17 39.3	- 18 05.8	- 18 32.6	21 39 22.7	21 40 05.5	21 40 49.2	1 22.9	76	41	102
+159 30.0	- 18 02.3	- 18 29.1	- 18 56.2	21 40 24.5	21 41 08.2	21 41 52.8	1 24.1	77	41	101
+160 00.0	- 18 25.5	- 18 52.6	- 19 20.0	21 41 27.6	21 42 12.2	21 42 57.7	1 25.3	78	42	101
+160 30.0	- 18 48.8	- 19 16.2	- 19 43.9	21 42 32.0	21 43 17.5	21 44 03.9	1 26.5	78	43	100

To correct for elevation above sea level, please see table of corrections, page 26.

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

SURFACE PATH OF THE TOTAL PHASE OVER LAND

Longitude		Northern Limit	Latitude of Central Line		Southern Limit	Universal Time at Central Line			Southern Limit	On Central Line		Sun's Alt.	Sun's Az.
			h	m		s	h	m		s	Maximum Duration		
°	'	°	'	°	'	h	m	s	h	m	s	m	km
+161	00.0	-19 12.3	-19 40.0	-20 07.9	21 43 37.7	21 44 24.1	21 45 11.4	1 27.6	79	44	100		
+161	30.0	-19 35.9	-20 03.8	-20 32.0	21 44 44.8	21 45 32.0	21 46 20.1	1 28.8	79	44	99		
+162	00.0	-19 59.5	-20 27.8	-20 56.2	21 45 53.0	21 46 41.2	21 47 30.1	1 30.0	80	45	99		
+162	30.0	-20 23.3	-20 51.8	-21 20.5	21 47 02.6	21 47 51.5	21 48 41.2	1 31.1	80	46	98		
+163	00.0	-20 47.2	-21 15.9	-21 44.9	21 48 13.3	21 49 03.1	21 49 53.6	1 32.3	81	47	97		
+163	30.0	-21 11.2	-21 40.1	-22 09.3	21 49 25.3	21 50 15.8	21 51 07.1	1 33.4	81	48	97		
+164	00.0	-21 35.2	-22 04.4	-22 33.8	21 50 38.4	21 51 29.7	21 52 21.7	1 34.6	82	48	96		
+164	30.0	-21 59.3	-22 28.7	-22 58.4	21 51 52.7	21 52 44.7	21 53 37.4	1 35.7	82	49	95		
+165	00.0	-22 23.5	-22 53.1	-23 22.9	21 53 08.0	21 54 00.7	21 54 54.1	1 36.9	83	50	95		
+165	30.0	-22 47.6	-23 17.4	-23 47.5	21 54 24.4	21 55 17.8	21 56 11.9	1 38.0	83	51	94		
+166	00.0	-23 11.8	-23 41.8	-24 12.0	21 55 41.9	21 56 35.9	21 57 30.5	1 39.1	83	52	93		
+166	30.0	-23 36.0	-24 06.2	-24 36.5	21 57 00.3	21 57 54.9	21 58 50.1	1 40.2	84	52	92		
+167	00.0	-24 00.2	-24 30.5	-25 01.0	21 58 19.7	21 59 14.8	22 00 10.5	1 41.3	84	53	92		
+167	30.0	-24 24.3	-24 54.8	-25 25.5	21 59 40.0	22 00 35.6	22 01 31.8	1 42.3	84	54	91		
+168	00.0	-24 48.4	-25 19.1	-25 49.8	22 01 01.1	22 01 57.2	22 02 53.8	1 43.4	85	55	90		
+168	30.0	-25 12.5	-25 43.2	-26 14.1	22 02 23.0	22 03 19.5	22 04 16.4	1 44.4	85	55	89		
+169	00.0	-25 36.5	-26 07.3	-26 38.3	22 03 45.6	22 04 42.5	22 05 39.8	1 45.4	85	56	88		
+169	30.0	-26 00.4	-26 31.3	-27 02.4	22 05 09.0	22 06 06.1	22 07 03.7	1 46.4	86	57	87		
+170	00.0	-26 24.2	-26 55.2	-27 26.4	22 06 33.0	22 07 30.3	22 08 28.1	1 47.4	86	58	86		
+170	30.0	-26 47.9	-27 19.0	-27 50.2	22 07 57.5	22 08 55.1	22 09 53.0	1 48.4	86	58	85		
+171	00.0	-27 11.5	-27 42.6	-28 13.9	22 09 22.6	22 10 20.3	22 11 18.3	1 49.3	86	59	83		
+171	30.0	-27 34.9	-28 06.1	-28 37.3	22 10 48.1	22 11 45.9	22 12 44.0	1 50.2	87	60	82		
+172	00.0	-27 58.2	-28 29.4	-29 00.7	22 12 14.1	22 13 11.9	22 14 10.0	1 51.1	87	60	81		
+172	30.0	-28 21.3	-28 52.5	-29 23.8	22 13 40.4	22 14 38.2	22 15 36.2	1 51.9	87	61	80		
+173	00.0	-28 44.2	-29 15.4	-29 46.7	22 15 07.0	22 16 04.7	22 17 02.6	1 52.8	87	62	78		
+173	30.0	-29 06.9	-29 38.1	-30 09.4	22 16 33.8	22 17 31.4	22 18 29.1	1 53.6	87	62	77		
+174	00.0	-29 29.5	-30 00.7	-30 31.9	22 18 00.8	22 18 58.3	22 19 55.7	1 54.3	88	63	75		
+174	30.0	-29 51.8	-30 22.9	-30 54.1	22 19 27.9	22 20 25.2	22 21 22.3	1 55.1	88	64	74		
+175	00.0	-30 13.9	-30 45.0	-31 16.1	22 20 55.2	22 21 52.1	22 22 48.9	1 55.8	88	64	72		
+175	30.0	-30 35.7	-31 06.8	-31 37.8	22 22 22.4	22 23 19.0	22 24 15.4	1 56.5	88	65	71		
+176	00.0	-30 57.3	-31 28.3	-31 59.3	22 23 49.6	22 24 45.8	22 25 41.8	1 57.1	88	65	69		
+176	30.0	-31 18.7	-31 49.6	-32 20.5	22 25 16.7	22 26 12.5	22 27 08.0	1 57.7	88	66	67		
+177	00.0	-31 39.8	-32 10.6	-32 41.4	22 26 43.7	22 27 39.0	22 28 34.0	1 58.3	88	67	65		
+177	30.0	-32 00.6	-32 31.3	-33 02.0	22 28 10.5	22 29 05.3	22 29 59.7	1 58.9	88	67	63		
+178	00.0	-32 21.1	-32 51.7	-33 22.3	22 29 37.2	22 30 31.3	22 31 25.1	1 59.4	88	68	61		
+178	30.0	-32 41.3	-33 11.8	-33 42.3	22 31 03.5	22 31 57.0	22 32 50.2	1 59.9	88	68	59		
+179	00.0	-33 01.3	-33 31.7	-34 02.0	22 32 29.6	22 33 22.4	22 34 14.9	2 00.4	88	68	57		
+179	30.0	-33 21.0	-33 51.2	-34 21.4	22 33 55.3	22 34 47.5	22 35 39.2	2 00.8	88	69	55		
-180	00.0	-33 40.3	-34 10.4	-34 40.5	22 35 20.6	22 36 12.1	22 37 03.1	2 01.2	88	69	53		
-179	30.0	-33 59.4	-34 29.4	-34 59.3	22 36 45.6	22 37 36.3	22 38 26.5	2 01.6	88	70	50		
-179	00.0	-34 18.1	-34 48.0	-35 17.7	22 38 10.1	22 39 00.0	22 39 49.4	2 02.0	88	70	48		
-178	30.0	-34 36.6	-35 06.3	-35 35.9	22 39 34.1	22 40 23.2	22 41 11.8	2 02.3	88	70	46		
-178	00.0	-34 54.7	-35 24.2	-35 53.7	22 40 57.7	22 41 45.9	22 42 33.6	2 02.6	88	70	43		
-177	30.0	-35 12.5	-35 41.9	-36 11.2	22 42 20.7	22 43 08.1	22 43 54.9	2 02.8	88	71	41		
-177	00.0	-35 30.0	-35 59.2	-36 28.4	22 43 43.2	22 44 29.7	22 45 15.6	2 03.0	88	71	38		
-176	30.0	-35 47.2	-36 16.2	-36 45.2	22 45 05.2	22 45 50.7	22 46 35.7	2 03.2	88	71	36		
-176	00.0	-36 04.0	-36 32.9	-37 01.7	22 46 26.5	22 47 11.2	22 47 55.2	2 03.4	88	71	33		
-175	30.0	-36 20.5	-36 49.3	-37 17.9	22 47 47.3	22 48 31.0	22 49 14.1	2 03.5	88	71	30		
-175	00.0	-36 36.8	-37 05.3	-37 33.8	22 49 07.4	22 49 50.2	22 50 32.3	2 03.6	88	71	28		
-174	30.0	-36 52.7	-37 21.1	-37 49.4	22 50 27.0	22 51 08.7	22 51 49.9	2 03.7	88	72	25		
-174	00.0	-37 08.3	-37 36.5	-38 04.6	22 51 45.9	22 52 26.7	22 53 06.8	2 03.8	88	72	23		
-173	30.0	-37 23.5	-37 51.6	-38 19.6	22 53 04.1	22 53 43.9	22 54 23.1	2 03.8	88	72	20		
-173	00.0	-37 38.5	-38 06.4	-38 34.2	22 54 21.7	22 55 00.5	22 55 38.7	2 03.8	88	72	17		
-172	30.0	-37 53.1	-38 20.8	-38 48.5	22 55 38.6	22 56 16.4	22 56 53.6	2 03.8	88	71	15		
-172	00.0	-38 07.5	-38 35.0	-39 02.5	22 56 54.9	22 57 31.7	22 58 07.8	2 03.8	87	71	12		
-171	30.0	-38 21.5	-38 48.9	-39 16.1	22 58 10.5	22 58 46.3	22 59 21.4	2 03.7	87	71	10		
-171	00.0	-38 35.2	-39 02.4	-39 29.5	22 59 25.4	23 00 00.2	23 00 34.3	2 03.6	87	71	7		
-170	30.0	-38 48.6	-39 15.7	-39 42.6	23 00 39.6	23 01 13.4	23 01 46.5	2 03.5	87	71	5		
-170	00.0	-39 01.7	-39 28.6	-39 55.4	23 01 53.2	23 02 25.9	23 02 58.0	2 03.3	87	71	3		
-169	30.0	-39 14.5	-39 41.2	-40 07.9	23 03 06.0	23 03 37.8	23 04 08.9	2 03.2	87	71	0		

To correct for elevation above sea level, please see table of corrections, page 26.

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

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SURFACE PATH OF THE TOTAL PHASE OVER LAND

Longitude	Latitude of			Universal Time at			On Central Line			Sun's
	Northern Limit	Central Line	Southern Limit	Northern Limit	Central Line	Southern Limit	Maximum Duration	Path Width	Alt.	
° ' "	° ' "	° ' "	° ' "	h m s	h m s	h m s	m s	km	°	Az. °
-169 00.0	-39 27.1	-39 53.6	-40 20.1	23 04 18.2	23 04 48.9	23 05 19.0	2 03.0	87	70	358
-168 30.0	-39 39.3	-40 05.7	-40 32.0	23 05 29.7	23 05 59.4	23 06 28.5	2 02.8	87	70	356
-168 00.0	-39 51.2	-40 17.4	-40 43.6	23 06 40.5	23 07 09.2	23 07 37.3	2 02.6	86	70	354
-167 30.0	-40 02.9	-40 28.9	-40 54.9	23 07 50.6	23 08 18.4	23 08 45.5	2 02.3	86	70	352
-167 00.0	-40 14.3	-40 40.2	-41 06.0	23 09 00.1	23 09 26.8	23 09 52.9	2 02.1	86	69	350
-166 30.0	-40 25.4	-40 51.1	-41 16.7	23 10 08.9	23 10 34.6	23 10 59.7	2 01.8	86	69	348
-166 00.0	-40 36.2	-41 01.7	-41 27.2	23 11 17.0	23 11 41.7	23 12 05.9	2 01.5	86	69	346
-165 30.0	-40 46.7	-41 12.1	-41 37.5	23 12 24.4	23 12 48.2	23 13 11.4	2 01.2	86	68	344
-165 00.0	-40 57.0	-41 22.3	-41 47.4	23 13 31.2	23 13 54.0	23 14 16.3	2 00.9	85	68	342
-164 30.0	-41 07.0	-41 32.1	-41 57.1	23 14 37.3	23 14 59.2	23 15 20.5	2 00.5	85	68	341
-164 00.0	-41 16.7	-41 41.7	-42 06.6	23 15 42.7	23 16 03.7	23 16 24.1	2 00.2	85	67	339
-163 30.0	-41 26.2	-41 51.0	-42 15.8	23 16 47.5	23 17 07.5	23 17 27.0	1 59.8	85	67	337
-163 00.0	-41 35.4	-42 00.1	-42 24.7	23 17 51.7	23 18 10.8	23 18 29.3	1 59.4	85	67	336
-162 30.0	-41 44.4	-42 08.9	-42 33.4	23 18 55.2	23 19 13.4	23 19 31.1	1 59.0	85	66	334
-162 00.0	-41 53.1	-42 17.5	-42 41.8	23 19 58.1	23 20 15.4	23 20 32.2	1 58.6	84	66	333
-161 30.0	-42 01.6	-42 25.8	-42 50.0	23 21 00.3	23 21 16.8	23 21 32.7	1 58.2	84	66	331
-161 00.0	-42 09.8	-42 33.9	-42 58.0	23 22 02.0	23 22 17.5	23 22 32.6	1 57.7	84	65	330
-160 30.0	-42 17.8	-42 41.8	-43 05.7	23 23 03.0	23 23 17.7	23 23 31.9	1 57.3	84	65	328
-160 00.0	-42 25.5	-42 49.4	-43 13.2	23 24 03.4	23 24 17.3	23 24 30.6	1 56.8	84	64	327
-159 30.0	-42 33.0	-42 56.8	-43 20.4	23 25 03.3	23 25 16.3	23 25 28.8	1 56.3	83	64	326
-159 00.0	-42 40.3	-43 03.9	-43 27.4	23 26 02.5	23 26 14.7	23 26 26.3	1 55.8	83	64	324
-158 30.0	-42 47.4	-43 10.8	-43 34.2	23 27 01.1	23 27 12.5	23 27 23.4	1 55.3	83	63	323
-158 00.0	-42 54.2	-43 17.5	-43 40.8	23 27 59.2	23 28 09.7	23 28 19.8	1 54.8	83	63	322
-157 30.0	-43 00.8	-43 24.0	-43 47.1	23 28 56.7	23 29 06.4	23 29 15.8	1 54.3	82	62	321
-157 00.0	-43 07.1	-43 30.2	-43 53.3	23 29 53.6	23 30 02.6	23 30 11.1	1 53.8	82	62	320
-156 30.0	-43 13.3	-43 36.3	-43 59.2	23 30 50.0	23 30 58.2	23 31 06.0	1 53.3	82	62	319
-156 00.0	-43 19.2	-43 42.1	-44 04.9	23 31 45.8	23 31 53.2	23 32 00.3	1 52.7	82	61	317
-155 30.0	-43 25.0	-43 47.7	-44 10.4	23 32 41.0	23 32 47.8	23 32 54.1	1 52.2	82	61	316
-155 00.0	-43 30.5	-43 53.1	-44 15.6	23 33 35.7	23 33 41.7	23 33 47.4	1 51.6	81	60	315
-154 30.0	-43 35.8	-43 58.3	-44 20.7	23 34 29.9	23 34 35.2	23 34 40.1	1 51.0	81	60	314
-154 00.0	-43 40.9	-44 03.2	-44 25.6	23 35 23.6	23 35 28.2	23 35 32.4	1 50.4	81	59	313
-153 30.0	-43 45.8	-44 08.0	-44 30.3	23 36 16.7	23 36 20.6	23 36 24.2	1 49.9	81	59	312
-153 00.0	-43 50.4	-44 12.6	-44 34.7	23 37 09.3	23 37 12.6	23 37 15.4	1 49.3	80	59	311
-152 30.0	-43 54.9	-44 17.0	-44 39.0	23 38 01.4	23 38 04.0	23 38 06.2	1 48.7	80	58	310
-152 00.0	-43 59.2	-44 21.2	-44 43.1	23 38 53.0	23 38 55.0	23 38 56.5	1 48.1	80	58	309
-151 30.0	-44 03.3	-44 25.2	-44 47.0	23 39 44.1	23 39 45.4	23 39 46.4	1 47.4	80	57	309
-151 00.0	-44 07.2	-44 29.0	-44 50.7	23 40 34.7	23 40 35.4	23 40 35.7	1 46.8	79	57	308
-150 30.0	-44 10.9	-44 32.6	-44 54.2	23 41 24.8	23 41 24.9	23 41 24.7	1 46.2	79	56	307
-150 00.0	-44 14.5	-44 36.0	-44 57.5	23 42 14.5	23 42 14.0	23 42 13.1	1 45.6	79	56	306

To correct for elevation above sea level, please see table of corrections, page 26.

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

U.T. h m	Maximum Eclipse		Sun's		Central Line		First Contact		V °
	Duration m s	Path Width km	Alt. °	Az. °	Longitude °	Latitude °	U.T. h m s	P °	
21 13	0 30.3	36	3	110	+130 34.7	- 1 31.0		...	...
21 14	0 37.0	42	8	110	+135 25.0	- 3 34.7		...	...
21 15	0 40.9	46	11	110	+137 59.6	- 4 47.5		...	...
21 16	0 44.1	49	14	110	+139 56.7	- 5 46.0	20 19 37.6	297	33
21 17	0 46.9	51	16	109	+141 33.9	- 6 36.9	20 19 55.4	297	33
21 18	0 49.3	53	17	109	+142 58.1	- 7 22.7	20 20 17.3	298	34
21 19	0 51.6	55	19	109	+144 13.2	- 8 04.9	20 20 42.1	298	34
21 20	0 53.6	57	21	109	+145 21.2	- 8 44.4	20 21 09.2	298	35
21 21	0 55.6	59	22	108	+146 23.8	- 9 21.6	20 21 38.2	298	35
21 22	0 57.5	60	23	108	+147 21.8	- 9 57.0	20 22 08.5	298	36
21 23	0 59.3	61	25	108	+148 16.2	-10 30.9	20 22 40.2	299	36
21 24	1 01.1	63	26	107	+149 07.3	-11 03.5	20 23 12.9	299	36
21 26	1 04.3	65	28	107	+150 41.7	-12 05.3	20 24 21.0	299	37
21 28	1 07.4	67	30	106	+152 07.7	-13 03.5	20 25 32.0	299	38
21 30	1 10.3	69	32	105	+153 27.0	-13 58.7	20 26 45.3	300	38
21 35	1 16.9	73	36	104	+156 23.3	-16 06.7	20 29 56.9	300	40
21 40	1 22.8	76	40	102	+158 57.3	-18 03.7	20 33 17.4	301	41
21 42	1 25.1	77	42	101	+159 54.3	-18 48.1	20 34 39.6	301	42
21 44	1 27.2	78	43	100	+160 49.2	-19 31.4	20 36 02.8	301	43
21 46	1 29.3	79	45	99	+161 42.2	-20 13.5	20 37 26.9	301	43
21 48	1 31.3	80	46	98	+162 33.6	-20 54.7	20 38 51.8	301	44
21 50	1 33.2	81	47	97	+163 23.5	-21 34.9	20 40 17.6	301	44
21 55	1 37.7	83	51	94	+165 23.1	-23 11.8	20 43 55.2	301	46
22 00	1 41.9	84	54	91	+167 16.8	-24 44.1	20 47 37.2	301	47
22 05	1 45.6	85	56	88	+169 06.3	-26 12.4	20 51 23.2	301	49
22 10	1 49.1	86	59	84	+170 52.8	-27 37.0	20 55 12.9	301	51
22 15	1 52.1	87	61	79	+172 37.5	-28 58.3	20 59 06.4	301	52
22 20	1 54.8	88	64	74	+174 21.3	-30 16.5	21 03 03.7	301	54
22 25	1 57.2	88	66	69	+176 04.9	-31 31.8	21 07 04.6	301	56
22 30	1 59.2	88	67	62	+177 49.1	-32 44.3	21 11 09.5	301	58
22 35	2 00.9	88	69	55	+179 34.4	-33 54.0	21 15 18.3	301	60
22 40	2 02.2	88	70	46	-178 38.3	-35 01.1	21 19 31.4	300	63
22 45	2 03.1	88	71	37	-176 48.7	-36 05.6	21 23 48.8	300	66
22 50	2 03.6	88	71	28	-174 56.2	-37 07.3	21 28 11.0	300	69
22 55	2 03.8	88	72	17	-173 00.1	-38 06.2	21 32 38.2	299	73
23 00	2 03.6	87	71	7	-171 00.0	-39 02.3	21 37 10.7	299	77
23 10	2 01.9	86	69	349	-166 45.3	-40 45.5	21 46 33.5	298	86
23 20	1 58.7	84	66	333	-162 07.4	-42 15.4	21 56 22.8	296	98
23 30	1 53.8	82	62	320	-157 01.3	-43 29.9	22 06 42.8	295	111
23 40	1 47.3	80	57	308	-151 21.2	-44 26.2	22 17 38.2	293	124
23 50	1 39.0	76	51	298	-144 59.7	-45 00.2	22 29 14.4	291	135
0 00	1 29.0	72	45	288	-137 46.2	-45 05.7	22 41 38.1	289	144
0 10	1 17.1	66	38	278	-129 21.8	-44 32.1	22 54 58.4	287	150
0 20	1 02.4	58	29	268	-119 02.7	-42 58.1	23 09 33.5	284	155
0 30	0 42.0	44	15	256	-103 49.0	-39 06.4	23 26 33.9	281	157
0 31	0 39.0	42	13	254	-101 28.0	-38 22.2	23 28 36.9	281	157
0 32	0 35.6	39	10	252	- 98 38.3	-37 26.4	23 30 51.4	281	158
0 33	0 31.0	35	7	250	- 94 46.9	-36 06.3	23 33 30.0	280	158

The magnitude is 1 or greater and the obscuration is 100% for all points.

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

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LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

U.T. at Maximum	Second Contact					Third Contact					Fourth Contact				
	h	U.T. m s	P °	V °		h	U.T. m s	P °	V °		h	U.T. m s	P °	V °	
21 13	21	12 44.9	116	207		21	13 15.2	296	27		22	10 58.2	118	203	
21 14	21	13 41.5	117	208		21	14 18.6	297	28		22	14 16.2	119	204	
21 15	21	14 39.6	118	209		21	15 20.5	298	29		22	16 36.8	119	205	
21 16	21	15 38.0	118	209		21	16 22.1	298	29		22	18 41.5	120	205	
21 17	21	16 36.6	119	210		21	17 23.5	299	30		22	20 37.5	120	206	
21 18	21	17 35.4	119	210		21	18 24.7	299	30		22	22 27.9	120	206	
21 19	21	18 34.3	119	211		21	19 25.9	299	31		22	24 14.3	121	206	
21 20	21	19 33.2	119	211		21	20 26.9	299	31		22	25 57.5	121	207	
21 21	21	20 32.2	120	212		21	21 27.9	300	32		22	27 38.2	121	207	
21 22	21	21 31.3	120	212		21	22 28.9	300	32		22	29 16.9	121	207	
21 23	21	22 30.4	120	212		21	23 29.8	300	32		22	30 53.8	121	208	
21 24	21	23 29.5	120	213		21	24 30.6	300	33		22	32 29.1	121	208	
21 26	21	25 27.9	120	214		21	26 32.3	300	34		22	35 36.0	122	209	
21 28	21	27 26.4	121	214		21	28 33.8	301	34		22	38 38.5	122	209	
21 30	21	29 24.9	121	215		21	30 35.2	301	35		22	41 37.3	122	210	
21 35	21	34 21.6	121	217		21	35 38.6	301	37		22	48 51.6	122	212	
21 40	21	39 18.7	122	218		21	40 41.5	302	38		22	55 51.0	123	214	
21 42	21	41 17.5	122	219		21	42 42.7	302	39		22	58 35.2	123	215	
21 44	21	43 16.5	122	220		21	44 43.7	302	40		23	01 17.5	123	216	
21 46	21	45 15.5	122	221		21	46 44.8	302	41		23	03 58.1	123	217	
21 48	21	47 14.4	122	221		21	48 45.8	302	41		23	06 37.0	123	219	
21 50	21	49 13.5	122	222		21	50 46.7	302	42		23	09 14.2	123	220	
21 55	21	54 11.2	122	224		21	55 49.0	302	44		23	15 40.4	123	224	
22 00	21	59 09.2	122	226		22	00 51.1	302	46		23	21 57.1	122	230	
22 05	22	04 07.3	122	229		22	05 52.9	302	49		23	28 04.7	122	237	
22 10	22	09 05.5	122	232		22	10 54.7	302	52		23	34 03.4	122	247	
22 15	22	14 04.0	122	235		22	15 56.2	302	55		23	39 53.3	121	259	
22 20	22	19 02.6	121	239		22	20 57.5	301	59		23	45 34.4	121	274	
22 25	22	24 01.5	121	243		22	25 58.7	301	63		23	51 07.0	120	288	
22 30	22	29 00.4	121	248		22	30 59.7	301	68		23	56 31.0	120	301	
22 35	22	33 59.6	120	253		22	36 00.5	300	74		0	01 46.6	119	311	
22 40	22	38 58.9	120	260		22	41 01.2	300	81		0	06 53.8	118	319	
22 45	22	43 58.5	119	267		22	46 01.6	299	88		0	11 52.8	118	324	
22 50	22	48 58.2	119	275		22	51 01.9	299	96		0	16 43.7	117	328	
22 55	22	53 58.1	118	283		22	56 01.9	298	104		0	21 26.8	116	331	
23 00	22	58 58.2	117	291		23	01 01.8	297	112		0	26 02.1	115	333	
23 10	23	08 59.0	116	304		23	11 01.0	296	126		0	34 50.4	114	335	
23 20	23	19 00.6	114	315		23	20 59.3	294	136		0	43 10.4	112	336	
23 30	23	29 03.0	113	323		23	30 56.9	293	143		0	51 03.8	110	336	
23 40	23	39 06.3	111	328		23	40 53.6	291	148		0	58 32.1	109	336	
23 50	23	49 10.4	109	331		23	50 49.5	289	151		1	05 35.9	107	335	
0 00	23	59 15.4	107	333		0	00 44.5	287	153		1	12 14.7	105	334	
0 10	0	09 21.4	105	334		0	10 38.5	285	154		1	18 24.7	104	333	
0 20	0	19 28.7	103	334		0	20 31.2	283	154		1	23 53.7	102	332	
0 30	0	29 39.0	101	334		0	30 21.0	281	154		1	27 47.1	100	330	
0 31	0	30 40.4	100	334		0	31 19.5	280	154		1	27 54.9	100	330	
0 32	0	31 42.2	100	334		0	32 17.8	280	154		..	..	..	..	..
0 33	0	32 44.4	100	334		0	33 15.5	280	154		..	..	..	..	..

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

Position		Name of Location	Duration of Totality m s	Width of Path km	U.T.			Maximum Eclipse		Sun's	
Longitude	Latitude				h	m	s	Obscuration %	Magnitude	Alt.	Az.
+139 08.0	-34 46.0	Adelaide, S. Australia			21	55	59.0	28.0	0.394	29	96
+174 46.6	-36 54.4	Auckland, New Zealand			22	32	27.5	83.8	0.867	64	58
+170 29.5	-45 52.4	Beverly-Begg Observatory, New Zealand			22	41	16.3	52.4	0.614	57	48
+173 48.2	-41 44.9	Black Birch Station, New Zealand			22	39	05.0	68.4	0.745	61	49
+147 05.5	-9 28.6	Boera, Papua New Guinea	0 14.4	59	21	21	20.3	100.0	1.000	23	108
+153 00.0	-27 30.0	Brisbane, Queensland			21	51	14.7	64.6	0.715	39	95
+149 08.0	-35 18.0	Canberra, A.C.T.			22	02	08.5	41.0	0.515	38	89
+174 46.0	-41 17.1	Carter Observatory, New Zealand			22	39	41.8	71.4	0.769	62	48
+172 38.0	-43 32.0	Christchurch, New Zealand			22	40	20.1	61.7	0.691	59	48
+149 33.6	-30 18.9	Culgoora, CSIRO, N.S.W.			21	53	44.6	51.9	0.610	37	94
+131 00.0	-12 25.0	Darwin, N. Territory			21	23	08.5	67.2	0.737	9	109
+147 06.0	-9 31.0	Daugo I., east end, Papua New Guinea	0 29.0	59	21	21	23.3	100.0	1.001	23	108
+147 03.0	-9 31.0	Daugo I., west end, Papua New Guinea	0 36.6	59	21	21	22.4	100.0	1.002	23	108
+170 30.0	-45 52.0	Dunedin, New Zealand			22	41	16.2	52.5	0.614	57	48
+178 00.0	-18 00.0	Fiji Islands			22	02	54.1	57.5	0.656	64	100
+147 20.0	-42 54.0	Hobart, Tasmania			22	14	23.6	25.4	0.369	39	82
+159 57.0	-9 28.0	Honiara, Guadalcanal I., Solomon I.			21	27	42.2	74.4	0.794	36	108
+147 44.0	-10 05.0	Hula, Hood Bay, Papua New Guinea	0 55.6	61	21	22	16.8	100.0	1.005	24	108
+145 00.0	-37 50.0	Melbourne, Victoria			22	04	02.4	30.5	0.418	35	89
+176 57.9	-43 59.2	Mt. John Observatory, New Zealand			22	38	15.7	57.0	0.652	58	52
+149 00.4	-35 19.2	Mt. Stromlo Observatory, A.C.T.			22	02	05.3	40.7	0.513	38	89
+166 48.0	-22 18.0	Noumea, New Caledonia, New Hebrides			21	55	00.6	96.2	0.966	52	95
-170 43.0	-14 16.0	Pago Pago, American Samoa			22	18	47.4	23.0	0.344	77	119
-130 06.0	-25 04.0	Pitcairn I.			0	21	12.3	28.4	0.398	36	262
+147 10.0	-9 28.0	Port Moresby, Papua New Guinea			21	21	20.8	98.2	0.983	23	108
+159 57.0	-19 15.0	Sandy I., midsection	0 36.4	78	21	42	46.7	100.0	1.001	42	100
+159 57.0	-19 07.0	Sandy I., north tip	1 07.5	78	21	42	33.4	100.0	1.004	42	100
+149 03.6	-31 16.4	Siding Spring Observatory, N.S.W.			21	55	03.9	49.0	0.585	37	93
+151 12.0	-33 55.0	Sydney, N.S.W.			22	01	08.1	47.1	0.568	40	89
+168 29.0	-17 50.0	Vila, Efate, New Hebrides			21	49	03.7	79.5	0.834	51	100
+174 47.0	-41 15.0	Wellington, New Zealand			22	39	39.8	71.5	0.770	62	48

Assumed to be sea level.

Names and spellings are not authoritative, nor do they imply any official recognition of status.

No correction for elevation or limb included.

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

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LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

Position		First Contact					Second Contact					Third Contact					Fourth Contact				
Longitude	Latitude	h	U.T.	s	P.	V.	h	U.T.	s	P.	V.	h	U.T.	s	P.	V.	h	U.T.	s	P.	V.
+139 08.0	-34 46.0	21	07	43.1	334	95											22	48	01.3	81	199
+174 46.6	-36 54.4	21	16	32.1	308	71											23	55	10.4	111	282
+170 29.5	-45 52.4	21	33	47.4	321	97											23	53	10.0	94	262
+173 48.2	-41 44.9	21	26	14.7	314	85											23	57	21.3	103	276
+147 05.5	-9 28.6	20	21	40.1	298	35	21	21	13.1	44	136	21	21	27.6	15	107	22	28	22.9	121	207
+153 00.0	-27 30.0	20	48	47.0	316	68											23	00	56.6	104	213
+149 08.0	-35 18.0	21	05	42.2	327	87											23	03	48.5	90	211
+174 46.0	-41 17.1	21	25	54.7	313	83											23	58	58.7	104	280
+172 38.0	-43 32.0	21	29	30.8	317	90											23	56	08.4	99	270
+149 33.6	-30 18.9	20	54	45.9	322	77											22	58	54.9	97	210
+131 00.0	-12 25.0	..	..	..	...	...											22	20	29.3	103	198
+147 06.0	-9 31.0	20	21	42.5	298	35	21	21	08.8	60	152	21	21	37.9	359	91	22	28	26.6	121	207
+147 03.0	-9 31.0	20	21	42.9	298	35	21	21	04.1	70	162	21	21	40.8	349	81	22	28	24.0	121	207
+170 30.0	-45 52.0	21	33	46.5	321	97											23	53	10.7	94	262
+178 00.0	-18 00.0	20	48	54.4	283	18											23	26	46.1	144	214
+147 20.0	-42 54.0	21	24	18.6	337	105											23	07	59.7	79	211
+159 57.0	-9 28.0	20	23	22.9	288	21											22	40	57.2	136	214
+147 44.0	-10 05.0	20	22	14.7	298	36	21	21	49.0	102	195	21	22	44.6	317	49	22	29	47.6	121	208
+145 00.0	-37 50.0	21	12	36.9	333	96											22	59	35.9	83	207
+176 57.9	-43 59.2	21	29	20.6	319	92											23	52	06.9	97	263
+149 00.4	-35 19.2	21	05	46.3	328	88											23	03	36.6	90	211
+166 48.0	-22 18.0	20	43	16.8	299	42											23	16	32.9	125	225
+170 43.0	-14 16.0	21	11	41.9	262	345											23	32	24.9	163	120
+130 06.0	-25 04.0	23	15	51.6	248	143											1	19	22.2	139	30
+147 10.0	-9 28.0	20	21	38.9	298	35											22	28	25.8	122	207
+159 57.0	-19 15.0	20	35	20.6	301	43	21	42	28.5	187	285	21	43	05.0	237	335	22	59	26.7	122	215
+159 57.0	-19 07.0	20	35	08.6	301	43	21	41	59.7	160	257	21	43	07.2	264	2	22	59	12.6	122	215
+149 03.6	-31 16.4	20	56	51.4	323	79											22	59	13.3	95	210
+151 12.0	-33 55.0	21	02	17.9	324	83											23	05	47.3	94	214
+168 29.0	-17 50.0	20	37	56.0	292	30											23	10	18.8	133	219
+174 47.0	-41 15.0	21	25	50.7	313	83											23	58	59.2	104	280

Dot leaders indicate the phenomenon occurs below the horizon. Blanks indicate the phenomenon does not occur for the location.

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

PATH OF THE TOTAL PHASE OVER LAND AT FLYING ALTITUDES

Longitude	Latitude of Northern Limit at			Latitude of Central Line at			Latitude of Southern Limit at		
	Sea Level	10,000 Ft.	40,000 Ft.	Sea Level	10,000 Ft.	40,000 Ft.	Sea Level	10,000 Ft.	40,000 Ft.
+140 00.0	- 5 32.8	- 5 31.8	- 5 28.9	- 5 47.7	- 5 46.7	- 5 43.7	- 6 02.7	- 6 01.7	- 5 58.7
+140 30.0	- 5 48.1	- 5 47.1	- 5 44.1	- 6 03.2	- 6 02.2	- 5 59.2	- 6 18.5	- 6 17.5	- 6 14.4
+141 00.0	- 6 03.5	- 6 02.5	- 5 59.5	- 6 18.9	- 6 17.9	- 6 14.8	- 6 34.5	- 6 33.4	- 6 30.3
+141 30.0	- 6 19.1	- 6 18.1	- 6 15.1	- 6 34.8	- 6 33.8	- 6 30.7	- 6 50.7	- 6 49.6	- 6 46.5
+142 00.0	- 6 35.0	- 6 33.9	- 6 30.9	- 6 50.9	- 6 49.9	- 6 46.8	- 7 07.1	- 7 06.0	- 7 02.9
+142 30.0	- 6 51.0	- 6 50.0	- 6 46.9	- 7 07.2	- 7 06.2	- 7 03.1	- 7 23.7	- 7 22.6	- 7 19.4
+143 00.0	- 7 07.2	- 7 06.2	- 7 03.1	- 7 23.8	- 7 22.7	- 7 19.6	- 7 40.5	- 7 39.4	- 7 36.2
+143 30.0	- 7 23.7	- 7 22.7	- 7 19.6	- 7 40.5	- 7 39.5	- 7 36.3	- 7 57.5	- 7 56.4	- 7 53.2
+144 00.0	- 7 40.3	- 7 39.3	- 7 36.2	- 7 57.5	- 7 56.4	- 7 53.2	- 8 14.7	- 8 13.7	- 8 10.5
+144 30.0	- 7 57.2	- 7 56.2	- 7 53.0	- 8 14.6	- 8 13.5	- 8 10.4	- 8 32.2	- 8 31.1	- 8 27.9
+145 00.0	- 8 14.3	- 8 13.2	- 8 10.1	- 8 32.0	- 8 30.9	- 8 27.7	- 8 49.8	- 8 48.8	- 8 45.5
+145 30.0	- 8 31.6	- 8 30.5	- 8 27.4	- 8 49.6	- 8 48.5	- 8 45.3	- 9 07.7	- 9 06.7	- 9 03.4
+146 00.0	- 8 49.1	- 8 48.0	- 8 44.9	- 9 07.4	- 9 06.3	- 9 03.1	- 9 25.8	- 9 24.8	- 9 21.5
+146 30.0	- 9 06.8	- 9 05.7	- 9 02.6	- 9 25.4	- 9 24.3	- 9 21.1	- 9 44.2	- 9 43.1	- 9 39.8
+147 00.0	- 9 24.8	- 9 23.7	- 9 20.5	- 9 43.6	- 9 42.6	- 9 39.3	- 10 02.7	- 10 01.6	- 9 58.3
+147 30.0	- 9 42.9	- 9 41.8	- 9 38.6	- 10 02.1	- 10 01.0	- 9 57.8	- 10 21.5	- 10 20.4	- 10 17.1
+148 00.0	- 10 01.3	- 10 00.2	- 9 57.0	- 10 20.8	- 10 19.7	- 10 16.4	- 10 40.5	- 10 39.4	- 10 36.1
+148 30.0	- 10 19.9	- 10 18.8	- 10 15.5	- 10 39.7	- 10 38.6	- 10 35.3	- 10 59.7	- 10 58.6	- 10 55.3
+149 00.0	- 10 38.7	- 10 37.6	- 10 34.3	- 10 58.8	- 10 57.7	- 10 54.4	- 11 19.2	- 11 18.0	- 11 14.7
+149 30.0	- 10 57.7	- 10 56.6	- 10 53.3	- 11 18.2	- 11 17.1	- 11 13.7	- 11 38.8	- 11 37.7	- 11 34.3
+150 00.0	- 11 17.0	- 11 15.9	- 11 12.6	- 11 37.7	- 11 36.6	- 11 33.3	- 11 58.7	- 11 57.6	- 11 54.2
+150 30.0	- 11 36.4	- 11 35.3	- 11 32.0	- 11 57.5	- 11 56.4	- 11 53.1	- 12 18.8	- 12 17.7	- 12 14.3
+151 00.0	- 11 56.1	- 11 55.0	- 11 51.7	- 12 17.5	- 12 16.4	- 12 13.1	- 12 39.2	- 12 38.0	- 12 34.6
+151 30.0	- 12 16.0	- 12 14.9	- 12 11.6	- 12 37.8	- 12 36.6	- 12 33.3	- 12 59.7	- 12 58.6	- 12 55.2
+152 00.0	- 12 36.1	- 12 35.0	- 12 31.7	- 12 58.2	- 12 57.1	- 12 53.7	- 13 20.5	- 13 19.3	- 13 15.9
+152 30.0	- 12 56.5	- 12 55.4	- 12 52.0	- 13 18.9	- 13 17.7	- 13 14.3	- 13 41.5	- 13 40.3	- 13 36.9
+153 00.0	- 13 17.0	- 13 15.9	- 13 12.6	- 13 39.7	- 13 38.6	- 13 35.2	- 14 02.7	- 14 01.5	- 13 58.1
+153 30.0	- 13 37.8	- 13 36.7	- 13 33.3	- 14 00.8	- 13 59.7	- 13 56.3	- 14 24.1	- 14 22.9	- 14 19.5
+154 00.0	- 13 58.8	- 13 57.6	- 13 54.3	- 14 22.1	- 14 21.0	- 14 17.6	- 14 45.7	- 14 44.6	- 14 41.1
+154 30.0	- 14 20.0	- 14 18.8	- 14 15.5	- 14 43.6	- 14 42.5	- 14 39.1	- 15 07.6	- 15 06.4	- 15 03.0
+155 00.0	- 14 41.3	- 14 40.2	- 14 36.8	- 15 05.3	- 15 04.2	- 15 00.8	- 15 29.6	- 15 28.4	- 15 25.0
+155 30.0	- 15 02.9	- 15 01.8	- 14 58.4	- 15 27.3	- 15 26.1	- 15 22.7	- 15 51.8	- 15 50.7	- 15 47.2
+156 00.0	- 15 24.7	- 15 23.6	- 15 20.2	- 15 49.4	- 15 48.2	- 15 44.8	- 16 14.3	- 16 13.1	- 16 09.6
+156 30.0	- 15 46.7	- 15 45.6	- 15 42.2	- 16 11.7	- 16 10.5	- 16 07.1	- 16 36.9	- 16 35.7	- 16 32.3
+157 00.0	- 16 08.9	- 16 07.7	- 16 04.3	- 16 34.1	- 16 33.0	- 16 29.6	- 16 59.7	- 16 58.5	- 16 55.1
+157 30.0	- 16 31.2	- 16 30.1	- 16 26.7	- 16 56.8	- 16 55.7	- 16 52.2	- 17 22.7	- 17 21.5	- 17 18.0
+158 00.0	- 16 53.7	- 16 52.6	- 16 49.2	- 17 19.6	- 17 18.5	- 17 15.1	- 17 45.8	- 17 44.7	- 17 41.2
+158 30.0	- 17 16.4	- 17 15.3	- 17 11.9	- 17 42.7	- 17 41.5	- 17 38.1	- 18 09.1	- 18 08.0	- 18 04.5
+159 00.0	- 17 39.3	- 17 38.2	- 17 34.8	- 18 05.8	- 18 04.7	- 18 01.3	- 18 32.6	- 18 31.4	- 18 28.0
+159 30.0	- 18 02.3	- 18 01.2	- 17 57.8	- 18 29.1	- 18 28.0	- 18 24.6	- 18 56.2	- 18 55.1	- 18 51.6
+160 00.0	- 18 25.5	- 18 24.4	- 18 21.0	- 18 52.6	- 18 51.5	- 18 48.1	- 19 20.0	- 19 18.8	- 19 15.4
+160 30.0	- 18 48.8	- 18 47.7	- 18 44.3	- 19 16.2	- 19 15.1	- 19 11.7	- 19 43.9	- 19 42.7	- 19 39.3
+161 00.0	- 19 12.3	- 19 11.2	- 19 07.8	- 19 40.0	- 19 38.8	- 19 35.4	- 20 07.9	- 20 06.7	- 20 03.3
+161 30.0	- 19 35.9	- 19 34.7	- 19 31.4	- 20 03.8	- 20 02.7	- 19 59.3	- 20 32.0	- 20 30.9	- 20 27.5
+162 00.0	- 19 59.5	- 19 58.4	- 19 55.1	- 20 27.8	- 20 26.6	- 20 23.3	- 20 56.2	- 20 55.1	- 20 51.7
+162 30.0	- 20 23.3	- 20 22.2	- 20 18.9	- 20 51.8	- 20 50.7	- 20 47.3	- 21 20.5	- 21 19.4	- 21 16.0
+163 00.0	- 20 47.2	- 20 46.1	- 20 42.8	- 21 15.9	- 21 14.8	- 21 11.5	- 21 44.9	- 21 43.8	- 21 40.4
+163 30.0	- 21 11.2	- 21 10.1	- 21 06.8	- 21 40.1	- 21 39.0	- 21 35.7	- 22 09.3	- 22 08.2	- 22 04.9
+164 00.0	- 21 35.2	- 21 34.1	- 21 30.8	- 22 04.4	- 22 03.3	- 22 00.0	- 22 33.8	- 22 32.7	- 22 29.4
+164 30.0	- 21 59.3	- 21 58.2	- 21 55.0	- 22 28.7	- 22 27.6	- 22 24.3	- 22 58.4	- 22 57.2	- 22 53.9
+165 00.0	- 22 23.5	- 22 22.4	- 22 19.1	- 22 53.1	- 22 52.0	- 22 48.7	- 23 22.9	- 23 21.8	- 23 18.5
+165 30.0	- 22 47.6	- 22 46.5	- 22 43.3	- 23 17.4	- 23 16.4	- 23 13.1	- 23 47.5	- 23 46.4	- 23 43.1
+166 00.0	- 23 11.8	- 23 10.7	- 23 07.5	- 23 41.8	- 23 40.7	- 23 37.5	- 24 12.0	- 24 10.9	- 24 07.7
+166 30.0	- 23 36.0	- 23 34.9	- 23 31.8	- 24 06.2	- 24 05.1	- 24 01.9	- 24 36.5	- 24 35.5	- 24 32.2
+167 00.0	- 24 00.2	- 23 59.1	- 23 56.0	- 24 30.5	- 24 29.4	- 24 26.3	- 25 01.0	- 25 00.0	- 24 56.8
+167 30.0	- 24 24.3	- 24 23.3	- 24 20.2	- 24 54.8	- 24 53.8	- 24 50.6	- 25 25.5	- 25 24.4	- 25 21.3
+168 00.0	- 24 48.4	- 24 47.4	- 24 44.3	- 25 19.1	- 25 18.0	- 25 14.9	- 25 49.8	- 25 48.8	- 25 45.7
+168 30.0	- 25 12.5	- 25 11.5	- 25 08.4	- 25 43.2	- 25 42.2	- 25 39.1	- 26 14.1	- 26 13.1	- 26 10.0
+169 00.0	- 25 36.5	- 25 35.5	- 25 32.4	- 26 07.3	- 26 06.3	- 26 03.3	- 26 38.3	- 26 37.3	- 26 34.2
+169 30.0	- 26 00.4	- 25 59.4	- 25 56.4	- 26 31.3	- 26 30.3	- 26 27.3	- 27 02.4	- 27 01.4	- 26 58.4
+170 00.0	- 26 24.2	- 26 23.2	- 26 20.2	- 26 55.2	- 26 54.2	- 26 51.2	- 27 26.4	- 27 25.4	- 27 22.4
+170 30.0	- 26 47.9	- 26 46.9	- 26 44.0	- 27 19.0	- 27 18.0	- 27 15.0	- 27 50.2	- 27 49.2	- 27 46.2
+171 00.0	- 27 11.5	- 27 10.5	- 27 07.6	- 27 42.6	- 27 41.6	- 27 38.7	- 28 13.9	- 28 12.9	- 28 10.0
+171 30.0	- 27 34.9	- 27 33.9	- 27 31.1	- 28 06.1	- 28 05.1	- 28 02.2	- 28 37.3	- 28 36.4	- 28 33.5
+172 00.0	- 27 58.2	- 27 57.2	- 27 54.4	- 28 29.4	- 28 28.4	- 28 25.6	- 29 00.7	- 28 59.7	- 28 56.9

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

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PATH OF THE TOTAL PHASE OVER LAND AT FLYING ALTITUDES

Longitude	Latitude of Northern Limit at			Latitude of Central Line at			Latitude of Southern Limit at		
	Sea Level	10,000 Ft.	40,000 Ft.	Sea Level	10,000 Ft.	40,000 Ft.	Sea Level	10,000 Ft.	40,000 Ft.
+172 30.0	-28 21.3	-28 20.3	-28 17.5	-28 52.5	-28 51.6	-28 48.7	-29 23.8	-29 22.9	-29 20.0
+173 00.0	-28 44.2	-28 43.3	-28 40.5	-29 15.4	-29 14.5	-29 11.7	-29 46.7	-29 45.8	-29 43.0
+173 30.0	-29 06.9	-29 06.0	-29 03.3	-29 38.1	-29 37.2	-29 34.5	-30 09.4	-30 08.5	-30 05.8
+174 00.0	-29 29.5	-29 28.6	-29 25.9	-30 00.7	-29 59.8	-29 57.1	-30 31.9	-30 31.0	-30 28.3
+174 30.0	-29 51.8	-29 50.9	-29 48.2	-30 22.9	-30 22.0	-30 19.4	-30 54.1	-30 53.2	-30 50.6
+175 00.0	-30 13.9	-30 13.0	-30 10.4	-30 45.0	-30 44.1	-30 41.5	-31 16.1	-31 15.2	-31 12.6
+175 30.0	-30 35.7	-30 34.9	-30 32.3	-31 06.8	-31 05.9	-31 03.3	-31 37.8	-31 37.0	-31 34.4
+176 00.0	-30 57.3	-30 56.5	-30 53.9	-31 28.3	-31 27.4	-31 24.9	-31 59.3	-31 58.4	-31 55.9
+176 30.0	-31 18.7	-31 17.8	-31 15.3	-31 49.6	-31 48.7	-31 46.2	-32 20.5	-32 19.6	-32 17.1
+177 00.0	-31 39.8	-31 38.9	-31 36.5	-32 10.6	-32 09.7	-32 07.3	-32 41.4	-32 40.5	-32 38.1
+177 30.0	-32 00.6	-31 59.8	-31 57.3	-32 31.3	-32 30.5	-32 28.0	-33 02.0	-33 01.2	-32 58.7
+178 00.0	-32 21.1	-32 20.3	-32 17.9	-32 51.7	-32 50.9	-32 48.5	-33 22.3	-33 21.5	-33 19.1
+178 30.0	-32 41.3	-32 40.6	-32 38.2	-33 11.8	-33 11.1	-33 08.7	-33 42.3	-33 41.5	-33 39.2
+179 00.0	-33 01.3	-33 00.5	-32 58.2	-33 31.7	-33 30.9	-33 28.6	-34 02.0	-34 01.2	-33 58.9
+179 30.0	-33 21.0	-33 20.2	-33 17.9	-33 51.2	-33 50.4	-33 48.2	-34 21.4	-34 20.7	-34 18.4
+180 00.0	-33 40.3	-33 39.6	-33 37.3	-34 10.4	-34 09.7	-34 07.4	-34 40.5	-34 39.8	-34 37.5
-179 30.0	-33 59.4	-33 58.6	-33 56.4	-34 29.4	-34 28.6	-34 26.4	-34 59.3	-34 58.5	-34 56.3
-179 00.0	-34 18.1	-34 17.4	-34 15.2	-34 48.0	-34 47.2	-34 45.0	-35 17.7	-35 17.0	-35 14.8
-178 30.0	-34 36.6	-34 35.8	-34 33.7	-35 06.3	-35 05.5	-35 03.4	-35 35.9	-35 35.2	-35 33.0
-178 00.0	-34 54.7	-34 54.0	-34 51.9	-35 24.2	-35 23.5	-35 21.4	-35 53.7	-35 53.0	-35 50.9
-177 30.0	-35 12.5	-35 11.8	-35 09.7	-35 41.9	-35 41.2	-35 39.1	-36 11.2	-36 10.5	-36 08.4
-177 00.0	-35 30.0	-35 29.3	-35 27.2	-35 59.2	-35 58.5	-35 56.4	-36 28.4	-36 27.7	-36 25.6
-176 30.0	-35 47.2	-35 46.5	-35 44.4	-36 16.2	-36 15.5	-36 13.5	-36 45.2	-36 44.5	-36 42.5
-176 00.0	-36 04.0	-36 03.3	-36 01.3	-36 32.9	-36 32.2	-36 30.2	-37 01.7	-37 01.1	-36 59.0
-175 30.0	-36 20.5	-36 19.9	-36 17.9	-36 49.3	-36 48.6	-36 46.6	-37 17.9	-37 17.3	-37 15.3
-175 00.0	-36 36.8	-36 36.1	-36 34.2	-37 05.3	-37 04.7	-37 02.7	-37 33.8	-37 33.2	-37 31.2
-174 30.0	-36 52.7	-36 52.0	-36 50.1	-37 21.1	-37 20.4	-37 18.5	-37 49.4	-37 48.7	-37 46.8
-174 00.0	-37 08.3	-37 07.6	-37 05.7	-37 36.5	-37 35.8	-37 33.9	-38 04.6	-38 04.0	-38 02.1
-173 30.0	-37 23.5	-37 22.9	-37 21.0	-37 51.6	-37 50.9	-37 49.1	-38 19.6	-38 18.9	-38 17.0
-173 00.0	-37 38.5	-37 37.9	-37 36.0	-38 06.4	-38 05.7	-38 03.9	-38 34.2	-38 33.5	-38 31.7
-172 30.0	-37 53.1	-37 52.5	-37 50.7	-38 20.8	-38 20.2	-38 18.4	-38 48.5	-38 47.9	-38 46.0
-172 00.0	-38 07.5	-38 06.8	-38 05.0	-38 35.0	-38 34.4	-38 32.6	-39 02.5	-39 01.9	-39 00.0
-171 30.0	-38 21.5	-38 20.9	-38 19.1	-38 48.9	-38 48.3	-38 46.5	-39 16.1	-39 15.5	-39 13.7
-171 00.0	-38 35.2	-38 34.6	-38 32.8	-39 02.4	-39 01.8	-39 00.0	-39 29.5	-39 28.9	-39 27.1
-170 30.0	-38 48.6	-38 48.0	-38 46.3	-39 15.7	-39 15.1	-39 13.3	-39 42.6	-39 42.0	-39 40.3
-170 00.0	-39 01.7	-39 01.2	-38 59.4	-39 28.6	-39 28.0	-39 26.3	-39 55.4	-39 54.8	-39 53.1
-169 30.0	-39 14.5	-39 14.0	-39 12.3	-39 41.2	-39 40.7	-39 39.0	-40 07.9	-40 07.3	-40 05.6
-169 00.0	-39 27.1	-39 26.5	-39 24.8	-39 53.6	-39 53.0	-39 51.3	-40 20.1	-40 19.5	-40 17.8
-168 30.0	-39 39.3	-39 38.7	-39 37.1	-40 05.7	-40 05.1	-40 03.4	-40 32.0	-40 31.4	-40 29.7
-168 00.0	-39 51.2	-39 50.7	-39 49.0	-40 17.4	-40 16.9	-40 15.2	-40 43.6	-40 43.0	-40 41.3
-167 30.0	-40 02.9	-40 02.3	-40 00.7	-40 28.9	-40 28.4	-40 26.7	-40 54.9	-40 54.4	-40 52.7
-167 00.0	-40 14.3	-40 13.7	-40 12.1	-40 40.2	-40 39.6	-40 38.0	-41 06.0	-41 05.4	-41 03.8
-166 30.0	-40 25.4	-40 24.8	-40 23.2	-40 51.1	-40 50.5	-40 48.9	-41 16.7	-41 16.2	-41 14.5
-166 00.0	-40 36.2	-40 35.6	-40 34.0	-41 01.7	-41 01.2	-40 59.6	-41 27.2	-41 26.7	-41 25.1
-165 30.0	-40 46.7	-40 46.2	-40 44.6	-41 12.1	-41 11.6	-41 10.0	-41 37.5	-41 36.9	-41 35.3
-165 00.0	-40 57.0	-40 56.5	-40 54.9	-41 22.3	-41 21.7	-41 20.1	-41 47.4	-41 46.9	-41 45.3
-164 30.0	-41 07.0	-41 06.5	-41 04.9	-41 32.1	-41 31.6	-41 30.0	-41 57.1	-41 56.6	-41 55.0
-164 00.0	-41 16.7	-41 16.2	-41 14.6	-41 41.7	-41 41.2	-41 39.6	-42 06.6	-42 06.1	-42 04.5
-163 30.0	-41 26.2	-41 25.7	-41 24.1	-41 51.0	-41 50.5	-41 48.9	-42 15.8	-42 15.3	-42 13.7
-163 00.0	-41 35.4	-41 34.9	-41 33.4	-42 00.1	-41 59.6	-41 58.0	-42 24.7	-42 24.2	-42 22.6
-162 30.0	-41 44.4	-41 43.9	-41 42.3	-42 08.9	-42 08.4	-42 06.9	-42 33.4	-42 32.9	-42 31.3
-162 00.0	-41 53.1	-41 52.6	-41 51.1	-42 17.5	-42 17.0	-42 15.4	-42 41.8	-42 41.3	-42 39.8
-161 30.0	-42 01.6	-42 01.1	-41 59.5	-42 25.8	-42 25.3	-42 23.8	-42 50.0	-42 49.5	-42 48.0
-161 00.0	-42 09.8	-42 09.3	-42 07.8	-42 33.9	-42 33.4	-42 31.9	-42 58.0	-42 57.5	-42 55.9
-160 30.0	-42 17.8	-42 17.3	-42 15.8	-42 41.8	-42 41.3	-42 39.7	-43 05.7	-43 05.2	-43 03.6
-160 00.0	-42 25.5	-42 25.0	-42 23.5	-42 49.4	-42 48.9	-42 47.3	-43 13.2	-43 12.7	-43 11.1
-159 30.0	-42 33.0	-42 32.5	-42 31.0	-42 56.8	-42 56.3	-42 54.7	-43 20.4	-43 19.9	-43 18.4
-159 00.0	-42 40.3	-42 39.8	-42 38.3	-43 03.9	-43 03.4	-43 01.9	-43 27.4	-43 26.9	-43 25.4
-158 30.0	-42 47.4	-42 46.9	-42 45.4	-43 10.8	-43 10.3	-43 08.8	-43 34.2	-43 33.7	-43 32.2
-158 00.0	-42 54.2	-42 53.7	-42 52.2	-43 17.5	-43 17.0	-43 15.5	-43 40.8	-43 40.3	-43 38.8
-157 30.0	-43 00.8	-43 00.3	-42 58.8	-43 24.0	-43 23.5	-43 22.0	-43 47.1	-43 46.6	-43 45.1
-157 00.0	-43 07.1	-43 06.6	-43 05.2	-43 30.2	-43 29.7	-43 28.2	-43 53.3	-43 52.7	-43 51.2
-156 30.0	-43 13.3	-43 12.8	-43 11.3	-43 36.3	-43 35.8	-43 34.3	-43 59.2	-43 58.7	-43 57.1
-156 00.0	-43 19.2	-43 18.7	-43 17.2	-43 42.1	-43 41.6	-43 40.1	-44 04.9	-44 04.4	-44 02.8
-155 30.0	-43 25.0	-43 24.5	-43 23.0	-43 47.7	-43 47.2	-43 45.7	-44 10.4	-44 09.9	-44 08.3

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

CORRECTIONS FOR ELEVATION ABOVE SEA LEVEL

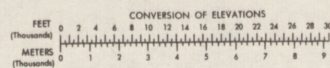
Longitude	Latitude	U.T.	Longitude	Latitude	U.T.	Longitude	Latitude	U.T.
°	"	s	°	"	s	°	"	s
+131 00.0	• • • •	• • • •	+161 00.0	6.786	-0.403	-169 00.0	3.411	0.006
+131 30.0	• • • •	• • • •	+161 30.0	6.764	-0.401	-168 30.0	3.379	0.012
+132 00.0	• • • •	• • • •	+162 00.0	6.740	-0.399	-168 00.0	3.349	0.019
+132 30.0	6.376	-0.390	+162 30.0	6.713	-0.397	-167 30.0	3.321	0.026
+133 00.0	5.747	-0.349	+163 00.0	6.683	-0.394	-167 00.0	3.294	0.032
+133 30.0	5.118	-0.307	+163 30.0	6.650	-0.391	-166 30.0	3.268	0.039
+134 00.0	5.057	-0.303	+164 00.0	6.614	-0.388	-166 00.0	3.244	0.045
+134 30.0	5.468	-0.330	+164 30.0	6.575	-0.384	-165 30.0	3.221	0.052
+135 00.0	5.625	-0.340	+165 00.0	6.534	-0.380	-165 00.0	3.199	0.058
+135 30.0	5.816	-0.353	+165 30.0	6.489	-0.376	-164 30.0	3.179	0.064
+136 00.0	5.771	-0.349	+166 00.0	6.442	-0.372	-164 00.0	3.160	0.070
+136 30.0	5.809	-0.352	+166 30.0	6.392	-0.367	-163 30.0	3.142	0.076
+137 00.0	5.861	-0.355	+167 00.0	6.339	-0.363	-163 00.0	3.126	0.082
+137 30.0	5.874	-0.356	+167 30.0	6.284	-0.357	-162 30.0	3.110	0.088
+138 00.0	5.925	-0.359	+168 00.0	6.226	-0.352	-162 00.0	3.096	0.093
+138 30.0	5.946	-0.360	+168 30.0	6.166	-0.346	-161 30.0	3.083	0.099
+139 00.0	5.989	-0.363	+169 00.0	6.103	-0.340	-161 00.0	3.071	0.104
+139 30.0	6.016	-0.364	+169 30.0	6.039	-0.334	-160 30.0	3.060	0.110
+140 00.0	6.054	-0.367	+170 00.0	5.973	-0.328	-160 00.0	3.050	0.115
+140 30.0	6.085	-0.368	+170 30.0	5.905	-0.321	-159 30.0	3.041	0.120
+141 00.0	6.120	-0.370	+171 00.0	5.836	-0.314	-159 00.0	3.033	0.125
+141 30.0	6.154	-0.372	+171 30.0	5.765	-0.307	-158 30.0	3.026	0.130
+142 00.0	6.186	-0.374	+172 00.0	5.693	-0.300	-158 00.0	3.020	0.135
+142 30.0	6.219	-0.376	+172 30.0	5.620	-0.293	-157 30.0	3.015	0.140
+143 00.0	6.253	-0.378	+173 00.0	5.546	-0.285	-157 00.0	3.011	0.145
+143 30.0	6.285	-0.380	+173 30.0	5.471	-0.278	-156 30.0	3.007	0.150
+144 00.0	6.317	-0.382	+174 00.0	5.396	-0.270	-156 00.0	3.005	0.155
+144 30.0	6.349	-0.384	+174 30.0	5.321	-0.262	-155 30.0	3.003	0.159
+145 00.0	6.380	-0.386	+175 00.0	5.246	-0.254	-155 00.0	3.002	0.164
+145 30.0	6.412	-0.388	+175 30.0	5.170	-0.245	-154 30.0	3.002	0.168
+146 00.0	6.442	-0.389	+176 00.0	5.095	-0.237	-154 00.0	3.002	0.173
+146 30.0	6.472	-0.391	+176 30.0	5.020	-0.229	-153 30.0	3.003	0.177
+147 00.0	6.502	-0.393	+177 00.0	4.946	-0.220	-153 00.0	3.005	0.181
+147 30.0	6.530	-0.395	+177 30.0	4.872	-0.212	-152 30.0	3.008	0.185
+148 00.0	6.558	-0.396	+178 00.0	4.800	-0.203	-152 00.0	3.012	0.190
+148 30.0	6.586	-0.398	+178 30.0	4.728	-0.194	-151 30.0	3.016	0.194
+149 00.0	6.612	-0.399	+179 00.0	4.657	-0.186	-151 00.0	3.020	0.198
+149 30.0	6.638	-0.401	+179 30.0	4.587	-0.177	-150 30.0	3.026	0.202
+150 00.0	6.662	-0.402	-180 00.0	4.518	-0.169	-150 00.0	3.032	0.205
+150 30.0	6.686	-0.404	-179 30.0	4.451	-0.160			
+151 00.0	6.708	-0.405	-179 00.0	4.385	-0.151			
+151 30.0	6.729	-0.406	-178 30.0	4.321	-0.143			
+152 00.0	6.749	-0.407	-178 00.0	4.258	-0.134			
+152 30.0	6.768	-0.408	-177 30.0	4.197	-0.126			
+153 00.0	6.785	-0.409	-177 00.0	4.137	-0.118			
+153 30.0	6.800	-0.410	-176 30.0	4.079	-0.109			
+154 00.0	6.814	-0.410	-176 00.0	4.023	-0.101			
+154 30.0	6.826	-0.411	-175 30.0	3.968	-0.093			
+155 00.0	6.837	-0.411	-175 00.0	3.915	-0.085			
+155 30.0	6.845	-0.412	-174 30.0	3.864	-0.077			
+156 00.0	6.851	-0.412	-174 00.0	3.814	-0.069			
+156 30.0	6.856	-0.412	-173 30.0	3.766	-0.061			
+157 00.0	6.858	-0.412	-173 00.0	3.720	-0.053			
+157 30.0	6.858	-0.411	-172 30.0	3.676	-0.046			
+158 00.0	6.855	-0.411	-172 00.0	3.633	-0.038			
+158 30.0	6.850	-0.410	-171 30.0	3.592	-0.030			
+159 00.0	6.843	-0.409	-171 00.0	3.552	-0.023			
+159 30.0	6.832	-0.408	-170 30.0	3.514	-0.016			
+160 00.0	6.820	-0.407	-170 00.0	3.478	-0.009			
+160 30.0	6.804	-0.405	-169 30.0	3.444	-0.001			

These corrections to latitude and time are to be applied to the data on pages 17-19 to correct for elevation. This table was constructed by differencing the data displayed on pages 24-25. The units are seconds of arc or seconds of time per thousand feet.

Example: Elevation 1,500 ft. at Long. 161.
 Lat. corr.: $6.786 \times 1.5 = 10.18 = 0.2$
 Time corr.: $-0.403 \times 1.5 = -0.6$

Hence for the first tabular entry on page 18, the three latitude entries should be shifted north by 0.2, and the three times advanced (made earlier) by 0.6.

ELEVATIONS IN FEET



MAXIMUM TERRAIN ELEVATIONS

Maximum Terrain elevation figures centered in the area bounded by ticked lines of LATITUDE and LONGITUDE, are represented in THOUSANDS and HUNDREDS of feet, BUT DO NOT IN-CLUDE ELEVATIONS OF VERTICAL OBSTRUCTIONS.

3100 feet **31**

ATTENTION THIS CHART CONTAINS MAXIMUM ELEVATION FIGURES (MEF)

The Maximum Elevation Figures shown in quadrangles bounded by ticked lines of latitude and longitude are represented in THOUSANDS and HUNDREDS of feet above mean sea level. The MEF is based on information available concerning the highest known feature in each quadrangle, including terrain and obstructions (trees, towers, antennas, etc.)

Example: 12,500 feet **12⁵**

CULTURE

Actual city outline..... Towns and villages (outline unknown).....
Land mark features (unillustrated).....
Primary roads..... Dual lane roads.....
Secondary roads.....
Tracks and trails..... Multiple track R.R.....
Single track R.R..... Power transmission line.....

VEGETATION

To assure legibility of significant relief, vegetation patterns are shown in relatively level areas only.

Vegetation.....

AERONAUTICAL INFORMATION

Major aerodromes.....
Runway pattern and 6000 foot diameter circle is shown at 1:500,000 scale. Center of circle represents true position of airfield.
Major aerodromes, runway pattern not available.....
Minor aerodromes.....
Seaplane base.....
Jet facilities available.....

Major aerodromes portrayed have a hard surface runway length of 3000 feet or more. When runway pattern is not shown, number following the name indicates length of longest runway to nearest hundreds of feet. Aerodrome elevations are in feet above sea level.

OBSTRUCTIONS

Vertical obstructions.....
Highest vertical obstruction (above MSL) within ticked lines of latitude and longitude.....

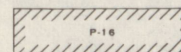
Multiple obstructions.....
Vertical obstructions with landmark significance.....

Numbers adjacent to obstruction indicate elevation of top of obstruction above mean sea level (MSL). Numbers in parentheses indicate height above ground level (AGL). Vertical obstructions under 200 feet in height (AGL) are not shown.

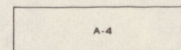
RADIO AIDS TO NAVIGATION

VHF OMNI RANGE (VOR).....
VORTAC.....
TACAN.....
VOR with DME.....
Other Facilities.....

SPECIAL USE AIRSPACE



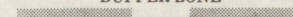
PROHIBITED AREAS



ALERT, CAUTION, DANGER
RESTRICTED OR WARNING AREA

NUMBERS INDICATE INTERNATIONALLY
RECOGNIZED NUMERICAL
IDENTIFICATION

BUFFER ZONE



CONTOUR INTERVAL

1000 feet
Intermediate contour shown at 500 feet
Auxiliary Contour shown at 250 and 750 foot intervals
Basic Intermediate Auxiliary
Dashed contours indicate approximate relief

CONTOURS

(Accuracy based on Mean Sea Level)
Accurate to within 500 feet.

SPOT ELEVATIONS

(Accuracy based on Mean Sea Level)

Maximum Vertical error 100 feet.....
Maximum Vertical error 400 feet.....
Approximate or doubtful location.....
Vertical error same as contours.....
Critical elevation.....
Lake and Stream elevation.....

GLOSSARY

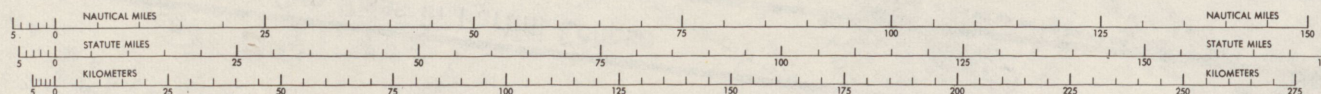
Batu..... Mountain
Bukit..... Mountain
Danau..... Lake
Gunung..... Mountain
Kali..... River
Kepulauan..... Mountains
Laut..... Sea
Nusa..... Island
Pegunungan..... Mountain range
Pulau..... Island
Rowa..... Flooded area
Selat..... Strait, Channel
Teluk..... Bay, Gulf
Tanjung..... Point, Cape
Ujung..... Point, Cape

NOTES

This chart is not an authority for international boundaries.

Power transmission line information on this chart is incomplete.

Geographic names or their spellings do not necessarily reflect recognition of the political status of an area by the United States Government.

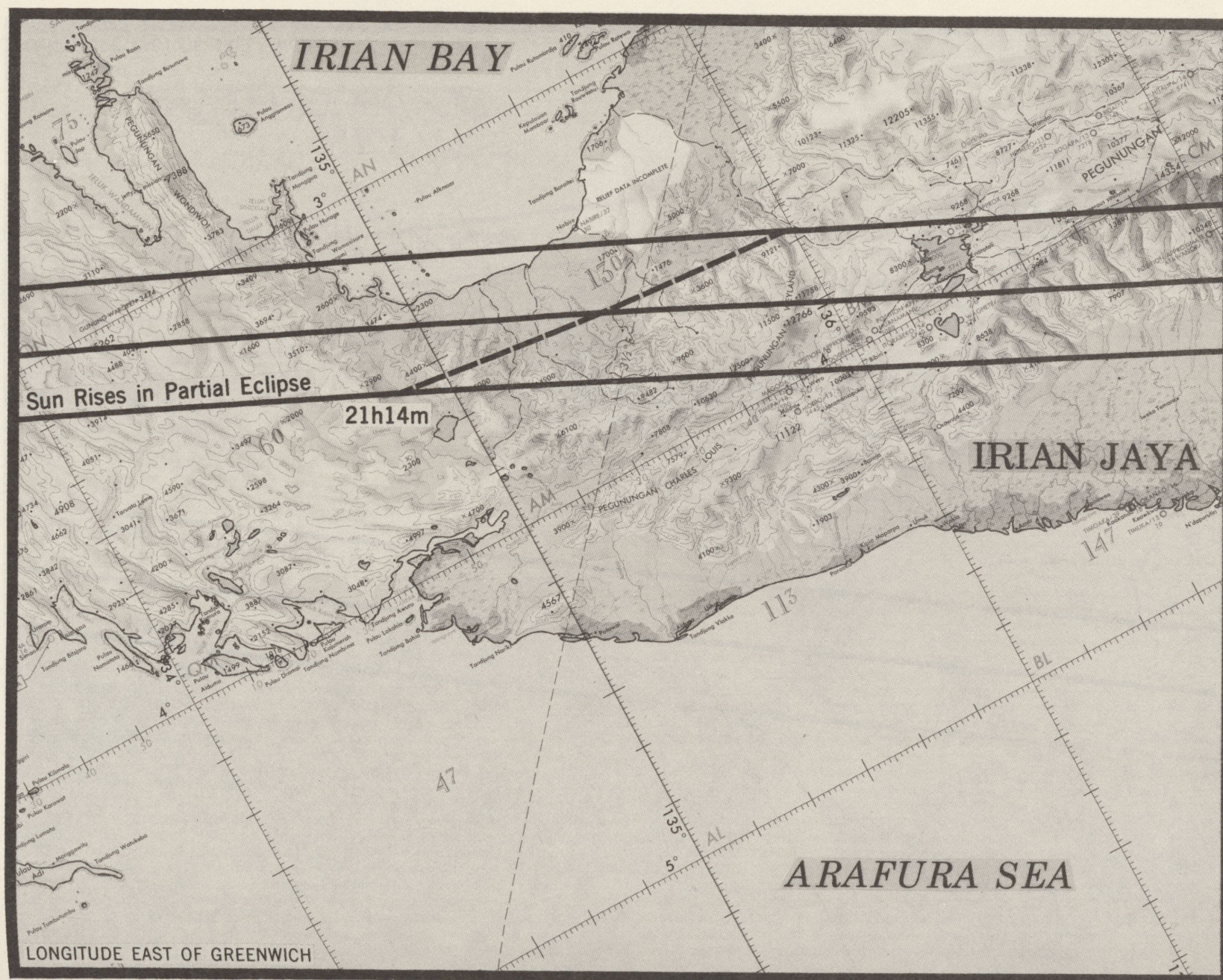


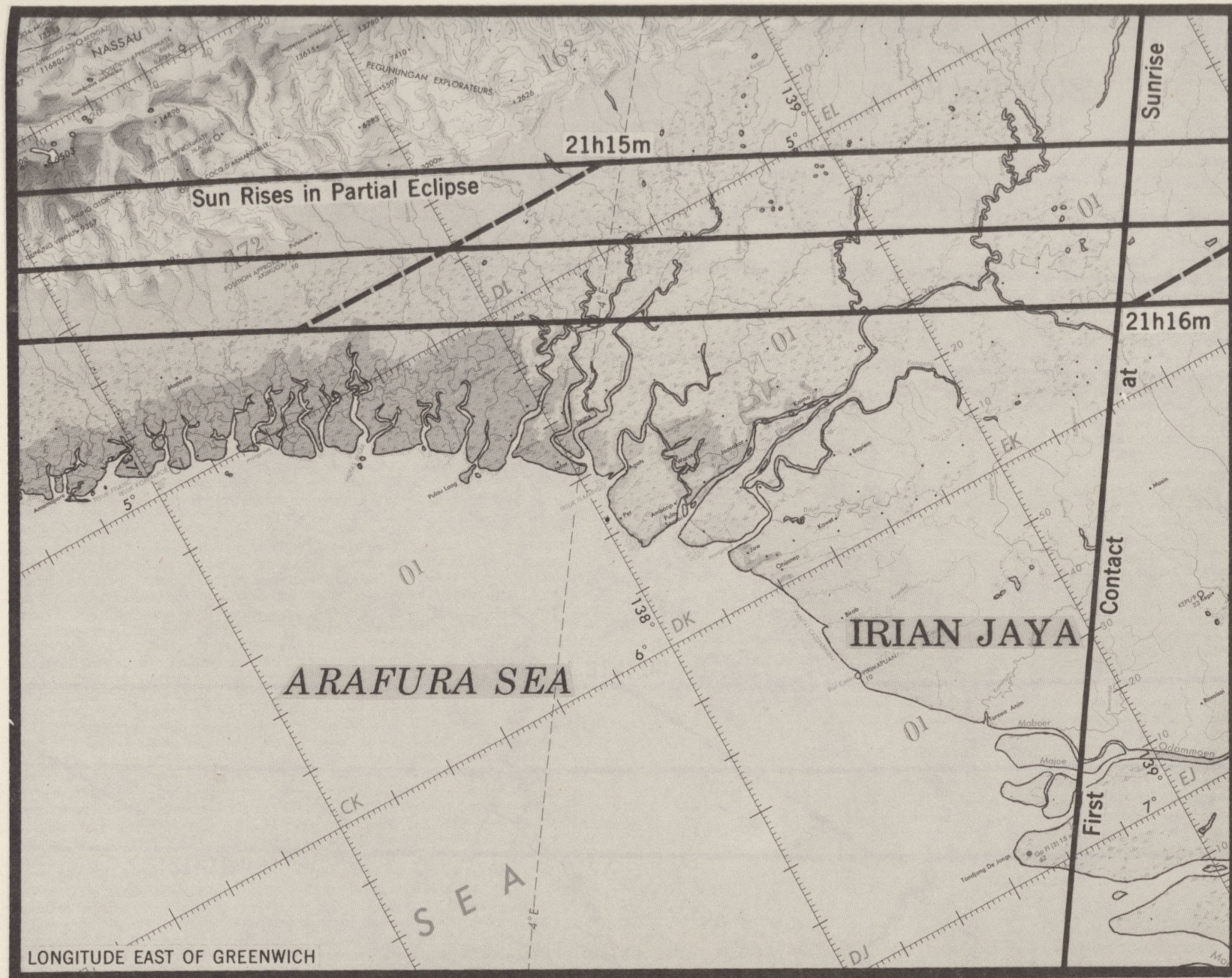
OPERATIONAL NAVIGATION CHART

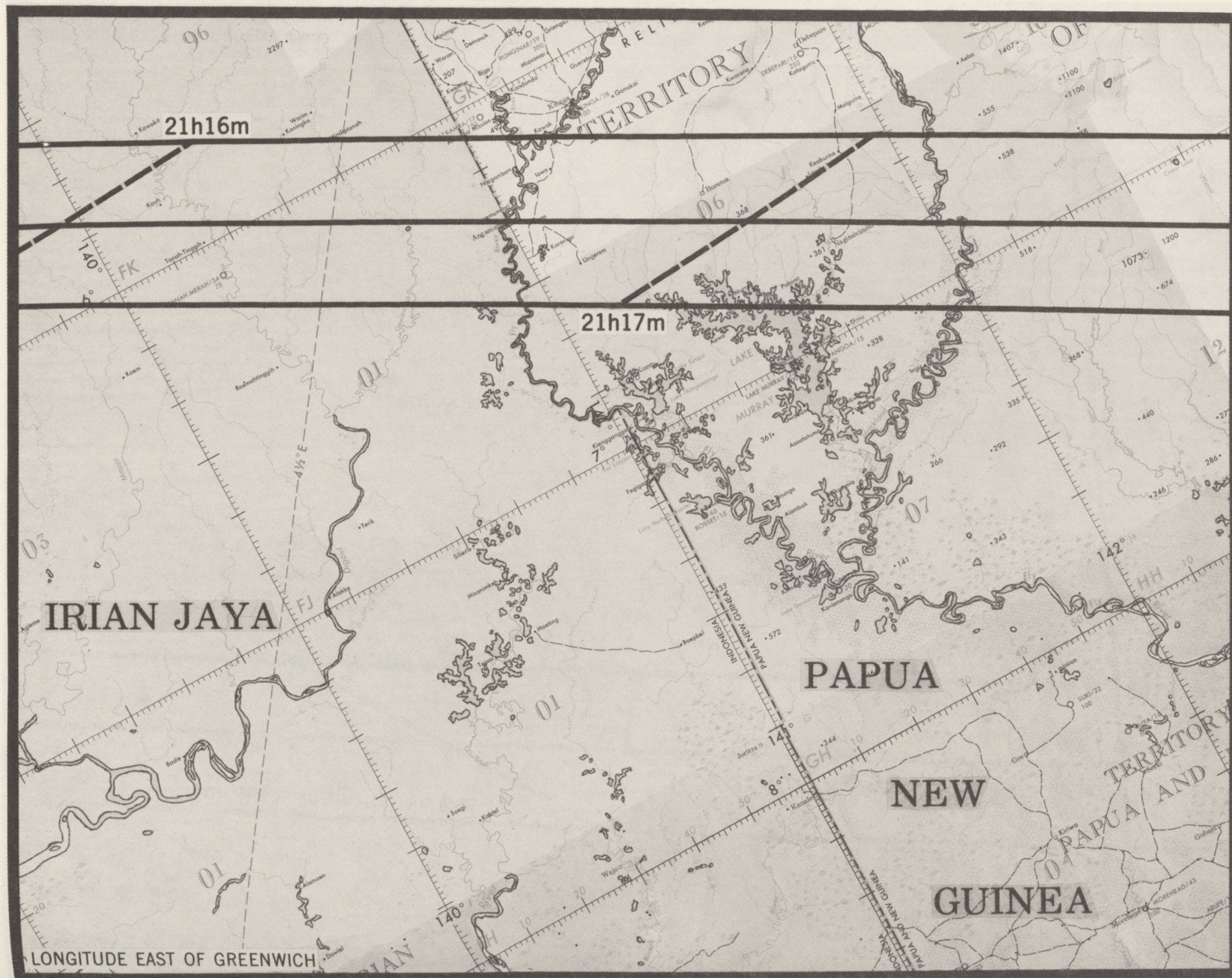
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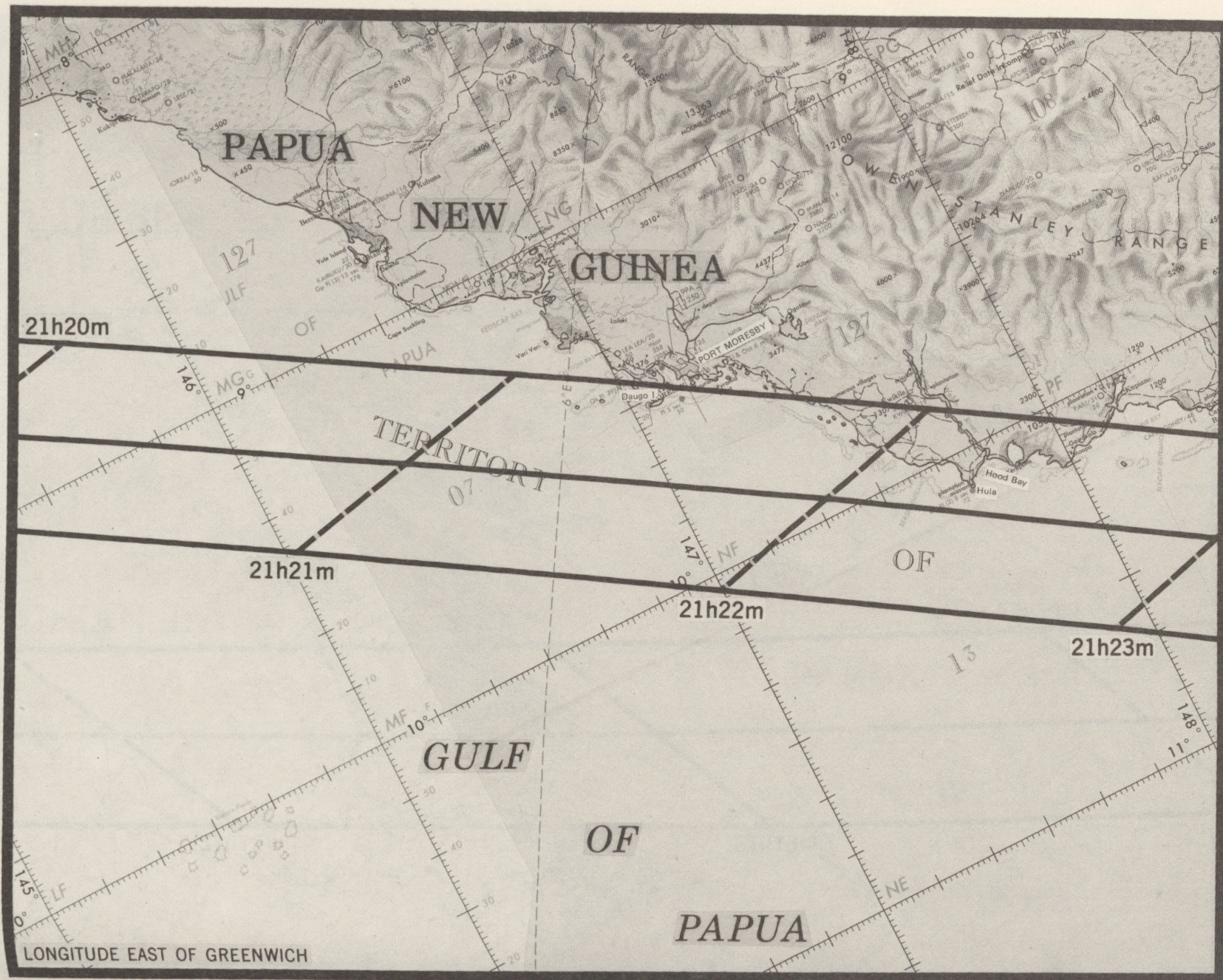
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Distribution Division (C-44)
National Ocean Survey.
Riverdale, MD. 20840

TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984









TOTAL SOLAR ECLIPSE OF 22-23 NOVEMBER 1984

